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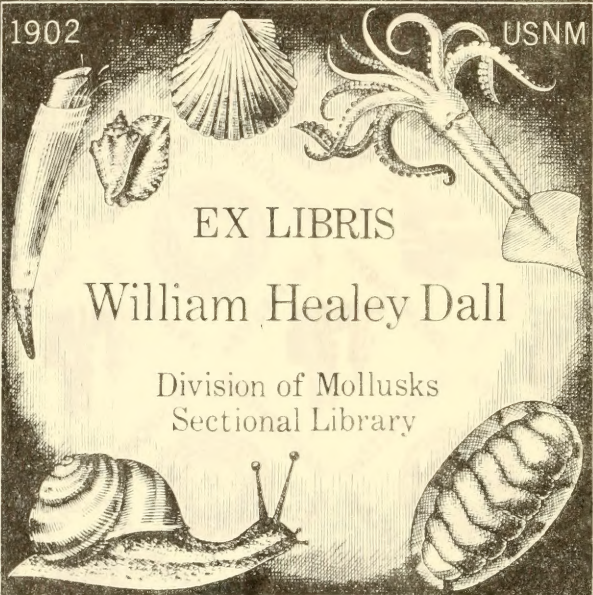
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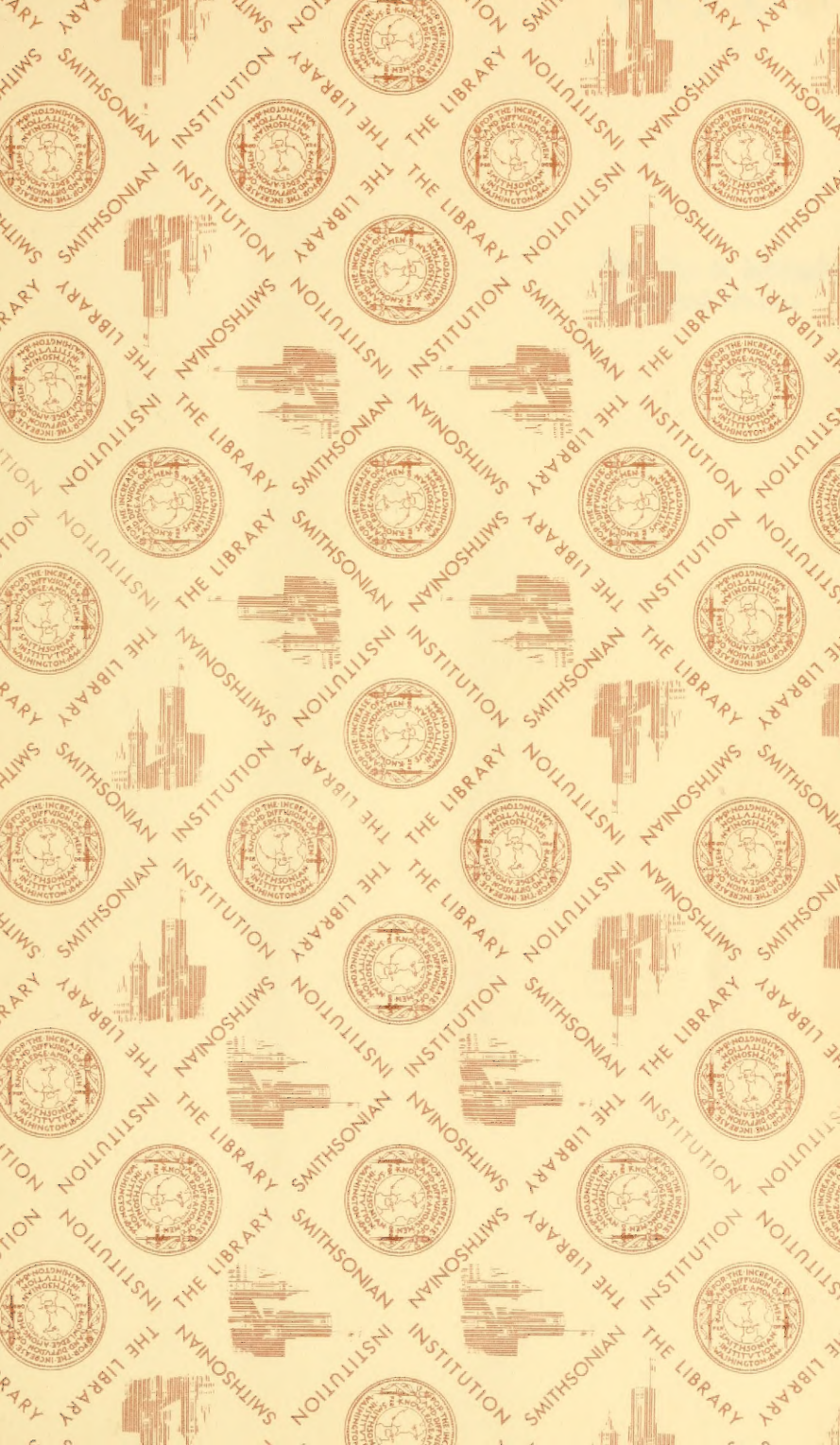
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ON SOME NUDIBRANCHS FROM ZANZIBAR. By

SIR CHARLES ELIOT, K.C.M.G., Commissioner and
Consul-General in the British East-African Protectorate.

[From the PROCEEDINGS OF THE ZOOLOGICAL SOCIETY OF LONDON,
May 6, 1902.]



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On some Nudibranchs from Zanzibar. By Sir CHARLES ELIOT, K.C.M.G., Commissioner and Consul-General in the British East-African Protectorate.

(Plates V. & VI.³ and Text-figures 2-5.)

During the last year Mr. Crossland has been most kindly investigating for me the fauna of the eastern and western coasts of Zanzibar. He has not only collected a large number of Opisthobranchs, but also greatly increased the value of his collection by drawings of the living animals. The present paper contains some of the results of his labours in the shape of notes on three apparently new genera of Nudibranchs—*Zatteria*, *Dunga* (Æolididæ), and *Crosslandia* (Scyllæidæ), and on two interesting species on which little seems to have been written since the time of Alder and Hancock—*Melibe fimbriata* and *Madrella ferruginosa*. The Æolididæ are already divided into forty or fifty genera, and it is with reluctance that I add to their number, believing that it would more properly be reduced. But as long as the definitions of the existing genera are so minute and narrow, they cannot be made to accommodate fresh forms, for which new, though probably only provisional, genera must be created.

ZATTERIA BROWN, gen. et sp. nov. (Plate VI. figs. 9-13.)

Three specimens were found in seaweed collected on the reefs round Prison Island, in Zanzibar Harbour, in May 1901. The largest was .8 cm. long by .2 cm. broad. The body is long and narrow, and terminates in a peculiarly slender tail, which is nearly a quarter of the length of the whole animal. The cerata are arranged in eight transverse rows (Pl. VI. fig. 10), each row containing eight cerata, four on each side. The first two rows and the last four are crowded together, but the two series in the middle are separated one from another and from the anterior and posterior clumps by considerable intervals. The most distinctive character of the genus is the shape of the cerata (Pl. VI. fig. 11), which are not even but swell out into two or three projecting rings, the first

³ For explanation of the Plates, see p. 72.

a little below the tip. Above the mouth are two short, slender, erect tentacles. Behind them are the rhinophores, which are considerably longer and more slender than the cerata: they bear about eight bracket-like semicircles, which alternate with one another, so that there is not a complete circle round the rhinophore; at the base of each rhinophore is a black eye-spot. The foot is rounded in front and the corners are not produced in tentacle-like expansions (Pl. VI. fig. 13).

The body is translucent and colourless (the viscera being white) with a few blotches formed of opaque white dots. The cerata are also translucent, except at the rings, which are opaque white; they bear a few orange spots or streaks. There is a long orange streak on each rhinophore.

The jaws are small and the masticatory edge is finely denticulate. The radula is short and uniseriate. Each tooth is shaped like a horse-shoe and bears on its anterior margin one large denticle with six small ones on each side (Pl. VI. fig. 12). No trace of armature was discoverable in the reproductive organs.

In many characters, in the disposition of the cerata, the rounded anterior margin of the foot, and the buccal parts, the animal appears allied to *Cratena*; but it differs in two points, the rudimentary perfoliation of the rhinophores and the rings round the cerata. The latter peculiarity is, so far as I am aware, unrecorded among the *Æolids*, but it almost entirely disappears in specimens preserved in alcohol, and it is therefore possible that it may really exist in other genera which have been described from such specimens.

DUNGA NODULOSA, gen. et sp. nov.

This animal is fairly common on colonies of *Sertularia*. The body and tail are both long. The cerata are easily detached and have then some power of independent movement. They are carried very erect in the living animal and are set in transverse rows varying from four to six in number. Behind the last transverse row is a clump of smaller cerata, also of varying number. Probably the caducous character of the appendages has something to do with these variations. Each transverse row consists of ten cerata, gradually increasing in size from the outside to the centre, the two middle ones being much larger than the others. The outer cerata are of the ordinary cylindrical shape; the middle ones are swollen and ovate, but terminate in a fine point. At the top of the broad part and at the base of this point are eight knobs. The rhinophores are very long and simple. The tentacles are moderately long, and the anterior angles of the foot are produced into processes of about the same length. The foot is narrow and without markings. The length varies from .5 to 1.2 cm.

The coloration is very variable and ranges from clear light yellow to purplish brown. These differences may be partly due to two different colours of the liver diverticula seen in the

transparent cerata. But in all cases the tips of the cerata are pink and the knobs of a brilliant white, with a white streak extending upwards and sometimes with white spots below. The back, cerata, rhinophores, and tentacles are covered with small spots of the same colour as the body but darker. The rhinophores have usually, but not always, dark circular bands. The intestines, which are clearly visible, are light or dark yellow.

The jaws are of moderate size; the masticatory edge is bluntly denticulate, but on the lower part only. The radula consists of a single row of teeth. The central part of each tooth is prolonged into a short bluntish point; on either side are three denticulations. I could discover no armature in the reproductive system.

The general characters and inflated cerata of this genus resemble the *Tergipedina*, and the figures of *Capellinia capellinii* (by Trinchese) and those of *Tergipes (Capellinia) dorie* (by Vayssi re) represent the cerata of these species as nodulous. But the *Tergipedina* have the foot rounded anteriorly, and the arrangement of the cerata in this animal is peculiar; it therefore seems necessary to create a new genus for it.

CROSSLANDIA VIRIDIS, gen. et sp. nov. (Plate V. figs. 1-8).

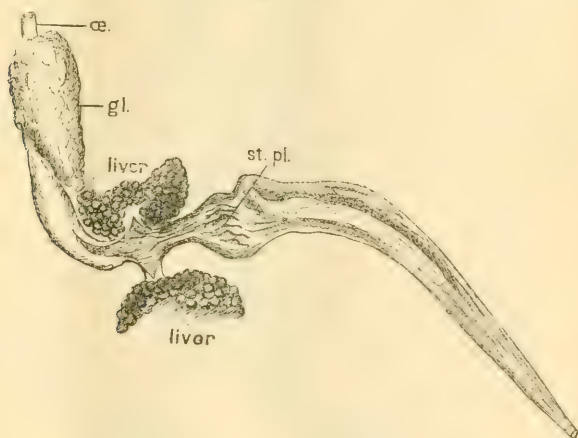
In July and September, 1901, were captured at Zanzibar four specimens of a nudibranch closely allied to *Scyll a*, though strikingly different in external appearance. The four specimens seem to constitute a new genus and possibly two species, though one may prove to be merely a well-marked variety. The animal in question may possibly be a *Nerea*, Lesson. I have not access to the original authorities, but Fischer's 'Manuel de Conchyliologie,' p. 536, says: "Le genre *Nerea*, Lesson, 1830, a  t  plac  dans le voisinage des *Scyll a*. Rhinophores courts, coniques, cili s, visibles au dessus d'un petit voile frontal: t te courte, tronqu e en avant; corps fournissant de chaque c t  deux lobes; branchies dispos es en petites touffes sur les lobes lat raux et sur la queue." From this description and from the fact that Bergh, in his 'System der Nudibranchiaten Gasteropoden,' takes no notice of *Nerea*, it may be presumed that the characters are not sufficiently defined to constitute a valid genus.

The length of a large specimen is nearly 5 centimetres, and the general appearance superficially resembles *Elysia* and in no way recalls *Scyll a*, which, however, I have never seen alive, although I have examined numerous alcoholic specimens. The body is fairly long; it is produced into a neck and tail and laterally into two wing-like lobes, one on each side, which are more or less distinctly bifid, but in no specimen can be compared to the two pair of cerata found in *Scyll a*, and are not constricted at the base. The animal when crawling generally directs them laterally. The colour is vivid green, harmonizing exactly with the young leaves of *Zostera* on which the animal was found. At the side of the body below the lobes is a row of irregular projecting sandy

markings. Round the edges of the lobes, the angles of the body, the ridge of the tail, the cups of the rhinophores, and the frontal veil runs a brown line. The surface of the body is covered with microscopic brown specks, which here and there are aggregated into spots just visible to the naked eye. There are also a few other spots.

There are no anterior tentacles, but a small frontal velum. The rhinophores are perfoliate and set in little open cups on the top of fairly long pillars, which are usually held nearly horizontally and have not any process behind as in *Scyllaea* (see Pl. V. fig. 5). The back and inside of the wings are covered with colourless, transparent contractile branchiae similar to those of *Scyllaea* (text-fig. 3, p. 66). On the tail is a slight ridge, not amounting to a crest. The foot is very narrow.

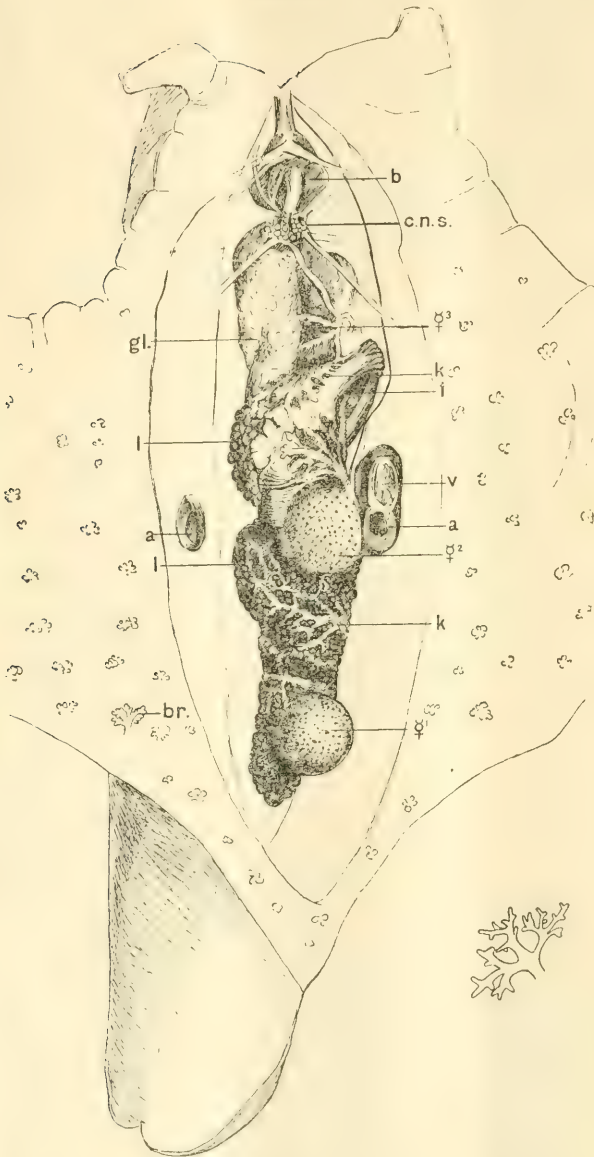
Text-fig. 2.

Digestive organs of *Crosslandia viridis*.

œ., cesophagus. | gl., gland. | st.pl., stomach-plates.

The body-cavity is spacious anteriorly until the commencement of the liver. After this point it is quite narrow, owing to the thickness of the soft transparent body-wall. The jaws (Pl. V. figs. 7, 8) are large and hinged dorsally. The masticatory edge is smooth and flexible, of a deep brown colour and bent outwards, the muscles being attached at the bend and covering the large stiff cheeks. The radula (Pl. V. figs. 4, 6) is short; each row consists of a median tooth and about 30 laterals on each side. The median tooth has a fairly large spine in the centre of the anterior margin and about 5 denticulations on each side, of which the pair nearest the centre are considerably larger than the others. The lateral teeth are also denticulate, but vary somewhat in form, and the corresponding teeth in the different rows do not always

Text-fig. 3.



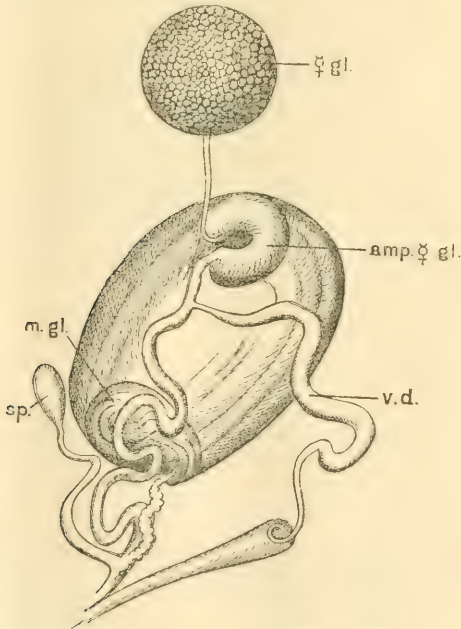
General view of the intestines of *Crosslandia viridis*.—The body has been opened by a cut made somewhat to the right and dividing the heart in two.

<i>a.</i> , auricle.	♂¹, ♂², ♂³, three hermaphrodite glands.	<i>k.</i> , kidney.
<i>b.</i> , buccal mass.	<i>gl.</i> , gland on œsophagus.	<i>l.</i> , liver.
<i>br.</i> , branchial tuft.	<i>i.</i> , intestine.	<i>v.</i> , ventricle.
<i>c.n.s.</i> , central nervous system.		

One branchial tuft enlarged is shown separately.

agree in shape. Those nearest the rhachis are generally denticulate on both sides: the ordinary teeth are denticulate only on the external side: those towards the end of the row are again denticulate on both sides but of a peculiar form; the outermost are degraded. On the œsophagus lies a large gland of apparently salivary functions. The œsophagus, which is narrow, broadens at this gland, and the digestive tract continues of much the same length until near its termination. On slitting it open (text-fig. 2, p. 65) the traces of a stomach are found, and an internal constriction is caused by the presence of a ring of large horny teeth. Just beyond this point is a large typhlosole with an irregularly laminated interior surface. The anus is lateral, beneath the right wing. The liver is in two compact masses, anterior and posterior; they send forth very slender light green diverticula, which until carefully examined have rather the appearance of veins, to the base of the wings and rhinophores.

Text-fig. 4.

Hermaphrodite gland of *Crosslandia viridis*.

<i>amp. ♂ gl.</i> , ampulla of hermaphrodite gland. <i>♂ gl.</i> , one of the three portions of the hermaphrodite gland.	<i>m. gl.</i> , mucous gland. <i>sp.</i> , spermatheca. <i>v.d.</i> , vas deferens.
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The ganglia in the central nervous system are distinct, the pedal being ventral to the œsophagus.

The pericardium (text-fig. 3, p. 66) is embedded in the body-wall: its pulsations are visible externally.

The kidney (text-fig. 3) is spread over the liver, and also on its ventral surface, as a number of distinct branching tubes, which continue in front of the liver, lying loosely in the body-cavity.

The hermaphrodite gland (text-fig. 4, p. 67) consists of three granular, spherical bodies, somewhat on the right side of the liver, one at each end and one in the middle, but not fused with it or embedded in it. The ampulla is large. There is only one spermatotheca. Prostates are absent, and the penis is small and unarmed.

It will thus be seen that in its internal structure this animal closely resembles *Scyllæa*. The only important difference is that the hepatic diverticula are very small and extend only to the bases of the wings, whereas in *Scyllæa* (? in all species) they are said to penetrate to the ends of the cerata and into the branchial tufts. I have wondered whether the creature could be a young *Scyllæa* in which the bifid lobes would subsequently divide into two pairs of cerata, but the size, which is as large as that of most *Scyllææ*, renders this improbable. Taken in conjunction with the character of the liver, the external differences (the wings instead of two pairs of cerata, the absence of a caudal crest and of flaps behind the rhinophores) seem sufficiently great to warrant the creation of a new genus, which I have named *Crosslandia* after Mr. Crossland, who dredged the first specimen.

One of the specimens (Pl. V. fig. 3) showed marked peculiarities, and is certainly a well-defined variety if not of a distinct species. The body was stouter and the outline more wrinkled and indented. The colour was that of *Fucus*, with a few pointed sandy projections and coralline purple spots. If it proves to be a distinct species I would call it *C. fusca*.

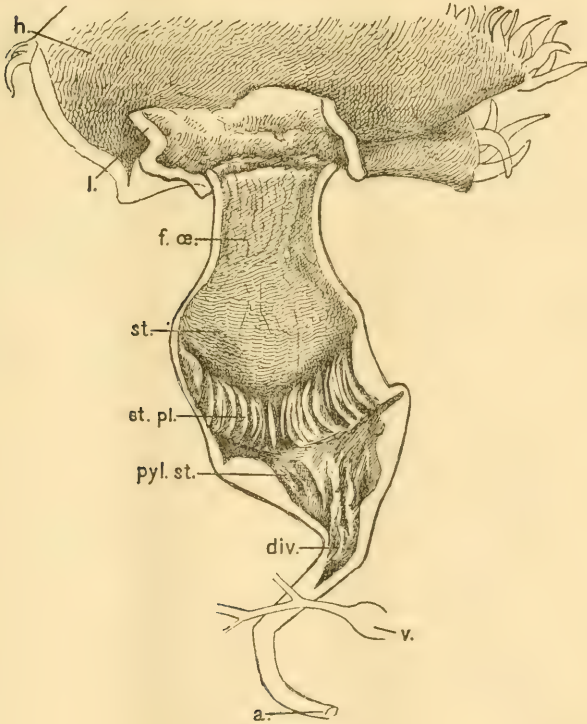
MELIBE FIMBRIATA Ald. & Hanc. Trans. Zool. Soc. vol. iii. pp. 137-139 (1864).

A large number of specimens of this remarkable animal were captured on both the east and west sides of Zanzibar in 1901. Alder and Hancock's figure and description give a good idea of its external appearance; but the coloration is very variable, ranging from clear bright yellow to ashy grey. Sometimes the colour is uniform, but more often the surface of the body and of the papillæ is marked with irregularly disposed spots and blotches, which may be black, white, grey, or sandy. These markings harmonize with the ordinary environment of the creature, and cause it to closely resemble a piece of seaweed besprinkled with sand and partially encrusted with sponges and other animal growths. In full-grown and perfect specimens, which are six inches long or more, the number of papillæ seems to be six or seven on each side of the body; but they are very easily detached, and few individuals have the two series complete.

I also found Alder and Hancock's description of the internal

anatomy to be correct, particularly as regards the absence of jaws. They say: "In *Melibe* the buccal organ is provided with neither tongue, jaws, nor collar." Bergh, in his monograph on the genus (in *Malac. Untersuch. in Semper's Reisen*, Th. ii. Bd. i. p. 363), thinks this statement will probably prove incorrect as other species of *Melibe* are provided with jaws, and he gives as a generic character: "Bulbus pharyngeus cum mandibulis aliquantulum ut in *Phylliroidis*: margo masticatorius mandibulae fortiter dentatus."

Text-fig. 5.

*Melibe fimbriata.*

a., anus.
div., diverticulum.
f.æ., folds of œsophagus.
h., hood.
l., lip.

pyl.st., pyloric portion of stomach.
st., thin-walled stomach.
st.pl., belt of stomach-plates.
v., ventricle of heart.

Mr. Crossland and I have, however, dissected several specimens of *Melibe fimbriata*, and in all failed to detect any trace of jaws. Our drawing (text-fig. 5) will perhaps explain clearly the structure of the digestive tract. In the centre and bottom of the hood is a protruding, circular, fleshy lip. This leads straight into the

œsophagus, which is provided with a series of folds, but no hard armature of any kind. The stomach is set with a belt of horny plates of two sizes and usually alternating regularly, the small being next to the large. The pyloric portion of the stomach below this belt is provided with muscular ridges, and passes almost imperceptibly into the intestine. At the point where it begins to be constricted is a pouch-like diverticulum with a laminated interior.

With the exception of the absence of jaws, the other characters of this animal clearly connect it with *Melibe*, not *Tethys*. The foot is very narrow, the body rather high and compressed; the cerata are covered with knots; the buccal opening passes straight into the œsophagus; the stomach is armed with plates; the liver is long and follicular and does not extend far into the cerata; the hermaphrodite gland is composed of many separate lobes at the side and under the liver. In *Tethys*, on the contrary, the foot is broad and the body flat; the cerata are smooth; there is a division of the alimentary canal before the œsophagus which may be called a buccal cavity; the liver is a compact mass sending diverticula to the ends of the cerata; the hermaphrodite gland forms a thick covering over the liver. Further, *Tethys* is described as possessing true branchiæ set at the base of the cerata. The back of *Melibe fimbriata* is covered with branched papillæ which bear a superficial resemblance to gills, but I could not discover that they have any special connection with the vascular system, and they seem analogous to the ramose appendages of *Plocamophorus* and some species of *Notarchus*.

It would thus appear that *Melibe fimbriata* is intermediate between *Tethys* and the jaw-bearing species of *Melibe*. It does not, however, seem necessary to create a new genus, but rather to modify the existing description of the genus and say *jaws present or absent*. The shape of the foot, body, and cerata, the presence of stomach-plates, the absence of branchiæ, and the character of the liver distinguish it sufficiently from *Tethys*.

In spite of its want of jaws, *Melibe fimbriata* is a most voracious animal, and I more than once found in the stomachs which I examined limbs of crustacea more than an inch long. The way in which it captures its prey is extremely curious. The circular oral veil acts as a net with an elastic rim. When seeking for food it expands the net and sweeps with it the surface over which it is crawling. The skin of the hood is stretched so tight as to be quite transparent and the marginal cirri are almost invisible. The moment a small crustacean or other prey is caught the net closes up, the cirri almost unite on the under surface, and the skin ceases to be perfectly transparent. Then the *Melibe* tosses the hood, which has now practically become a closed sac, backwards, and creates a current of water with the cirri, which forces its prey towards its mouth. The movements of the animal are rapid and energetic, whether it crawls or swims. It can also float on the surface foot uppermost.

MADRELLA FERRUGINOSA. (Plate VI. figs. 14-16.)

Madrella ferruginea Ald. & Hanc. Trans. Zool. Soc. iii. pp. 141-2 (1864).

No fresh details have, I believe, been published respecting this genus since Alder and Hancock's description. I have seen two specimens at Zanzibar, one about half an inch long and the other nearly double the size. The colour of the body is a deep coppery red. Round the edge of the mantle, including the anterior margin, are transparent copper-coloured cerata, into each of which passes a very short diverticulum of the liver. The black or deep purple ramifications of the liver are visible through the dorsal integuments. There are many more cerata in the large than in the smaller specimen, and it is therefore possible that they increase with age. The middle of the dorsal area is bare, except that it carries several irregularly distributed tubercles or papillae. In the large specimen they pass between the rhinophores and form a sort of rudimentary crest, but in the smaller specimen, though they occur on the back, they do not pass between the rhinophores. The large specimen had a white blotch between the rhinophores, the smaller none. The form of the rhinophores is somewhat unusual. They are not perfoliate, but there is a circle of papillae round the top of the club, somewhat as in *Tritonia*. There are no anterior tentacles, but the head is very broad and crescent-shaped, with produced ends. The front of the foot is wide and square, but the corners are not prominent. The mouth is ventral. Both the mantle-edge and the foot are wide, but between them is a deep groove. In crawling the foot projects beyond the mantle. The mantle overhangs the head and forms a wide frontal veil. The genital orifices are in the anterior part of the right-hand side, the anus in the posterior part, distinctly lateral and not dorsal.

The internal anatomy, so far as I could examine it, agreed with the description of Alder and Hancock. I was unable to see any salivary glands. The jaws are very large, enclosing the buccal mass, but not denticulate. The radula (Pl. VI. fig. 16) is triseriate and long. The median tooth has a strong blunt spine in the centre and about 7 denticulations on each side. The laterals have a large spine on the outer margin and 8 or 9 denticulations on the inner side. These denticulations seem therefore somewhat less numerous than those described by A. & H. The ganglia in the central nervous system are very distinct. *Madrella* appears to be sluggish in its movements. In confinement it discharged some fluid, which imparted a ferruginous colour to the water round it. This discharge did not appear to proceed from any particular organ, but from the whole surface of the body.

The genus forms an interesting connecting link between the Janidae and other Æolidæ. The arrangement of the liver and cerata connect it decisively with the former, but in its lateral anus and triseriate radula it approaches the general characters of the group and departs from the exceptional peculiarities of the Janidae,

which have a dorsal anus and a multiseriate radula. As a family the Janidæ are characterized by the presence of hepatic diverticula and of cerata in the anterior portion of the dorsal surface, in front of the rhinophores. Another character peculiar to the family, but not universal in it, is the crest between the rhinophores. There are four well-marked genera:—*Madrella*, with lateral anus, triseriate radula, papillous rhinophores, a rudimentary crest, and jaws without teeth. The other three genera have the additional peculiarities of a dorsal anus and a multiseriate radula. *Proctonotus* has simple rhinophores, no crest, and jaws without denticles. *Janolus* has perfoliate mandibles and very large jaws without denticles; the foot is also exceptionally broad. *Janus* has perfoliate rhinophores, a toothed mandible, and a crest.

EXPLANATION OF THE PLATES.

PLATE V.

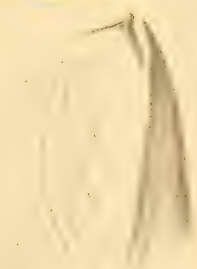
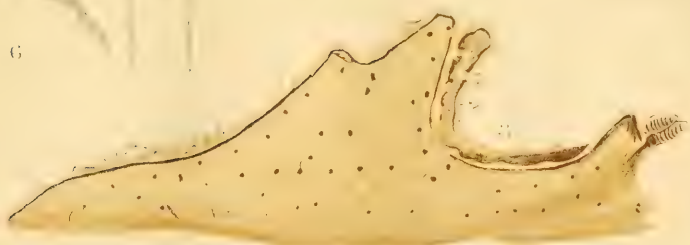
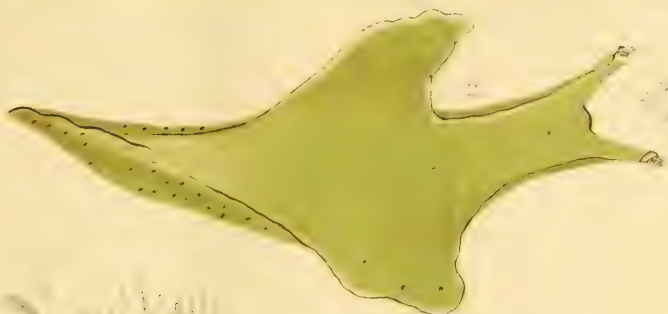
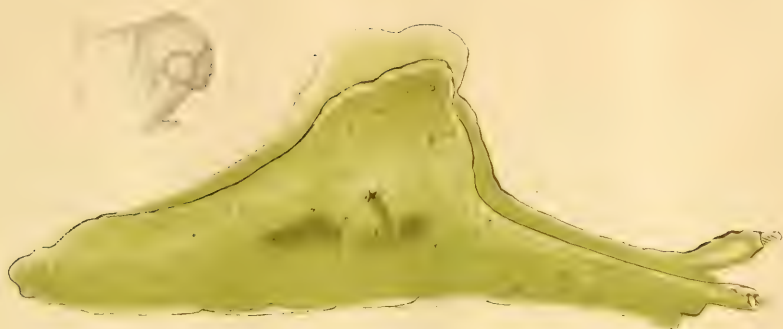
Figs. 1, 2. *Crosslandia viridis*, p. 64.

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|----|---|---|--|
| 3. | " | " | var. (?) <i>fusca</i> . |
| 4. | " | " | outer teeth of two consecutive rows of the radula. |
| 5. | " | " | rhinophore cup, one side removed. |
| 6. | " | " | central and inner teeth of radula. |
| 7. | " | " | jaws, from in front. |
| 8. | " | " | jaws, from the side. |

PLATE VI.

Fig. 9. *Zatteria browni*, p. 62.

- | | | | |
|---------|-------------------------------|--------|---|
| 10. | " | " | diagrammatic view showing position of cerata. |
| 11. | " | " | one of the cerata. |
| 12. | " | " | tooth of radula. |
| 13. | " | " | view of head from below. |
| 14, 15. | <i>Madrella ferruginosa</i> , | p. 71, | dorsal and ventral view. |
| 16. | " | " | one row of radula— <i>a</i> , median; <i>b</i> , lateral teeth. |





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On some Nudibranchs from East Africa and Zanzibar.
Part II.¹ By Sir C. ELIOT, K.C.M.G., H.M. Commissioner for the East Africa Protectorate, F.Z.S.

CERATOPHYLLIDIA AFRICANA, gen. et sp. nov.

One specimen from near Wasin, E. Africa, in 9 fathoms.

The living animal was described by Mr. Crossland, who dredged it, as of a light greenish-yellow colour on the upper surface, but with the foot, branchiæ, and under side of mantle, white. The back was very hard and smooth, but its most remarkable characteristic was the presence of a number of papillæ, consisting of round or pear-shaped bodies set on stalks. The stalks as well as the base and tip of these globes were white, but the middle part was black, owing to a dense aggregation of black spots, which, however, can be seen to be separate under a lens. The globes were quite soft and the stalks flexible; they shook when the animal was moved, but were not observed to execute any spontaneous movements. The mantle-edge was wavy.

The alcoholic specimen is of a uniform pale lemon-yellow, the black bands of the globes being, however, preserved. The breadth across the middle of the back is 1.9 centim. Unfortunately the animal is contracted almost into a circle, but apparently the length, when stretched out, must have been about 2.2 centim. The consistency of the body is like hard wax, and fragments of the mantle, which is ample, could easily be detached with the forceps. The whole dorsal surface is a mass of closely packed spicules. It bears about a hundred of the stalked globes. They are of very varying size; many are quite minute, but the largest is about 3 millim. high including the stalk, and about 2 millim. across the ball, which is quite soft and can easily be pressed flat. They are distributed over the whole of the back irregularly, and not in any pattern, but are perhaps thickest round the mantle-edge, including the space in front of the rhinophores. Both the

¹ For Part I. see P. Z. S. 1902, vol. ii. p. 62.

rhinophore-pockets and the anal papilla project; the edges are smooth. In the preserved specimen the rhinophores are grey.

The branchiæ are arranged in a circuit interrupted only by the head and genital papilla. They vary in size, but though in places long and short branchiæ seem to alternate, this cannot be said to be the general rule.

Over the mouth are two tentacles each about 1.5 millim. long, and 1 millim. broad at the base. They are not directed sideways but straight forward, and being set close together so that the division is not visible, they appear to form a sort of head. They are united at their bases. The mouth is larger than is usual in this order, and though it is suctorial is hardly poriform. Though the animal was dissected only three months after capture, the internal organs were already much dried and shrivelled, the spirit having apparently been unable to penetrate the hard integument. It was clear, however, that the buccal organs are of the type of *Phyllidiopsis* rather than *Phyllidia*. The buccal opening led into a sausage-shaped tube about 6 millim. long and 2 millim. broad, with muscular walls transversely striped. This passed into a long, narrow, coiled tube, which preserved the same calibre until it dilated into the stomach. Two ample glands (salivary?) entered the larger part of the tube on either side, but were not in any way fused with it. The liver was large and undivided behind.

The central nervous system was enclosed in a thin capsule and somewhat concentrated, the cerebral and pleural ganglia being hardly distinguishable and the pedal ganglia lying beneath them. The eyes were large, black, and distinct. The genital mass was much hardened, but the two spermathecae, one white and empty and the other black and full, were quite distinct. It was impossible to ascertain whether the glans was armed with hooks and whether the folds on the dorsal wall of the pericardium (sometimes called the pericardial gill) were present, but it is highly probable that the species possesses these family characteristics.

In virtue of its buccal apparatus this animal belongs to Bergh's genus *Phyllidiopsis*, although the tentacles are not attached through their whole length and are rather larger than is usual in the *Phyllidiadæ*. It is remarkable that the genus *Phyllidiopsis* contains one species, *Ph. papilligera*, which has also black papillæ on the back. To me, the presence of these dorsal papillæ seems a peculiarity sufficiently marked to merit generic rank. If *Echinodoris* is a genus, why should not *Phyllidiadæ* which have the same peculiarity enjoy the same distinction? I would propose to call the genus *Ceratophyllidia*, and its characters will be:—*Back studded with papillæ; buccal apparatus in the known species similar to that of Phyllidiopsis.*

PLEUROPHYLLIDIELLA HORATII, gen. et sp. nov.

One specimen from Wasin, East Africa. Mr. Crossland, who captured it, gives the following notes on the living animal:—
"Three inches long. Mantle edged with light salmon-colour; it

ends in two ridges near rhinophores, similarly edged; front edge of velum similarly edged. Back grey, mottled with a darker shade, the top of the numerous longitudinal ridges being sprinkled with clear black spots. Underside white. Gills also white. Rhinophores longitudinally lamellated, grey in colour, and can be contracted or retracted, though the pockets do not seem very definite or complete."

The somewhat bent alcoholic specimen measures 3 centim. from head to tail, but would be at least .5 longer if it were straightened out. The breadth of the back is 1.5 centim., of the foot .6. The foot is long and narrow, pointed behind and truncate in front, the corners not projecting.

No caruncle or nuchal papillæ are visible, but it is somewhat difficult to reconcile the head-parts of the preserved specimen with the description quoted above. According to a rough drawing made from the living animal, it would seem that the mantle-edge passes between the rhinophores and forms a sort of velum in front of them; but in the preserved specimen it appears to lie behind them as in an ordinary *Pleurophyllidia*, and not to pass through them at all.

The salient character of the genus is that there are no branchiæ and no trace of a branchial cleft. Lateral lamellæ are, however, present. They are situated exclusively on the under edge of the mantle, and not on the sides of the body. They extend from the head to the tail, and are about 30 in number on each side. They are irregular in size and shape. Some terminate before they reach the mantle-edge, and some run from the mantle-edge only halfway to the body. The genital papilla is 4 millim. and the vent 1.2 centim. from the anterior end of the body. Chidophores are distinctly visible round the edge of the mantle.

The mouth is ventral, and forms a large transverse slit, with slight indications of a T-shape. The jaws are yellow, narrow, and united so as to form a shape like a boat. They bear no denticles, but there are a few irregular coarse indentations of the edge, due apparently to its being jagged by use. The radula consists of about 30 rows, the formula for each of which is about $50 + 1 + 50$. The central tooth consists of a squarish basal plate with a long cusp, which bears about 10 denticles on each of its sides. The first lateral is larger than the others and resembles the central tooth, except that the denticles are only on the internal side. The second and third laterals are also denticulate; the rest appear to be simply hamate.

This form appears to be intermediate between *Pleuroleura*, which has neither branchial clefts nor side lamellæ, and *Pleurophyllidia*, which has both. I have indicated its affinities by the name *Pleurophyllidiella*.

BÆOLIDIA MAJOR, n. sp.

(Bergh, in Semper's Reisen im Arch. Philipp., Malac. Untersuch. vol. iii. pp. 778-780, 1880.)

One specimen from Chuaka, E. coast of Zanzibar, under a stone between tides.

The living animal was about 4 centimetres long. The body and appendages were of a uniform greyish white, with spots of a dull opaque white. The whole animal closely resembled a kind of detachable sea-anemone which is very common at Chuaka, and appears to be sometimes almost free-swimming.

The alcoholic specimen is 3 centim. long and 1 centim. broad at the widest part, including the cerata. The foot is moderately broad, and has fairly long tentacular expansions in front; but its most remarkable character is the size and distinctness of the anterior groove, which measures 2 millim. across. The upper lip is separated into two parts by a deep cleft. The oral tentacles are large and very thick. The rhinophores are shorter and studded with minute knobs, which, in the preserved specimen at any rate, appear not to be set in rings. The cerata are much flattened and almost leaf-like, and the hepatic diverticula within them are ramified. They begin at the anterior end of the large pericardial prominence, and are arranged in about 17 groups on each side, each containing about 10 cerata. There are very distinct gaps between the anterior groups, and a broad bare space runs down the middle of the back, but towards the end of the body the cerata are huddled together and continue until the extreme tip, there being no tail. The outermost cerata of all the rows are smaller, and the inner considerably larger, but at the base of the innermost are frequently quite small, some hardly larger than tubercles. The genital orifice is below the first group of cerata, and the lateral vent behind the second.

The specimen was only partially dissected. The jaws are very large, colourless and transparent, with a perfectly smooth edge. The radula consists of 32 pectinate teeth, very similar to those of *B. mæbii* (see Bergh, *l. c.* pl. lxxix. fig. 16), with striations under each denticle. They are, however, very much broader, the widest measuring 2 millim., and the denticles are more irregular in shape, being probably worn by use. There are about 150 of them on the broader teeth. The three or four central denticles are generally, but not always, smaller than the others.

This specimen is clearly referable to Bergh's genus *Bæolidia*, and the difference between it and the type is mainly one of size, *B. mæbii* being only 8 millim. long. The similarity of habitat makes one think that this may be merely a full-grown individual of the same species; and we know so little of the variations which the radula and arrangement of cerata may present in *Æolids* at the different periods of their growth, that I am not prepared to reject this hypothesis. Still, the single specimen examined by Bergh appears to have been sexually mature, and this being so the two animals each present peculiarities amounting to specific differences:—(1) In *B. mæbii* the tentacles are said to be "abgeplattet fingerförmig"; the cerata begin behind the rhinophores and are set in rows: in *B. major* the tentacles are stout and round;

the cerata begin further back and are set in groups. (2) In *B. mobii* the reproductive orifice is under the third row of cerata, and the vent between the sixth and seventh rows, almost dorsal : in *B. major* the reproductive orifice is under the first group of cerata, and the lateral vent after the second. (3) In *B. major* the basal part of the teeth is proportionally narrower than in *B. mobii*, and the denticles are more irregular.

Var. ORNATA.

One specimen captured at Chuaka, May 1902, seemed to be a typical *Baeolidia major*, except for a somewhat more ornate coloration. The ground-colour was of a yellowish-white with a yellowish-brown pattern, consisting of a series of irregularly shaped lozenges containing white spots, down the middle of the back as in *B. major*. The oral tentacles were white with green stripes. The cerata were white with yellow tips, below which was a bright blue band.

CERBERILLA AFRICANA, n. sp.

(Bergh, Journ. Mus. Godef. Heft ii. 1873, & Heft vi. 1874 ; Beitr. zur Kenntniss der Aeolidiaden, Theil ii. ; Semper's Reisen im Arch. Philipp., Malac. Untersuch. iii. p. 879.)

One specimen from the reef Jembiani, Zanzibar, 3·5 centim. long and 1·3 broad in life. The back was almost entirely covered with cerata, so that the body-colour was hardly visible. Most of the cerata were very dark green with a bright yellow ring, but the innermost were white with bluish tips, with only a ring of dark green. The oral tentacles were dark blue, with green bases. The rhinophores had four bands of colour, which were, starting from the base, greenish brown, white, blue, white. On the head were two yellow lines, extending from the oral tentacles to the rhinophores, and the margins of the head and foot were also of a bright light yellow.

The animal was stoutly built. The foot projected considerably beyond the body on either side. Its anterior angles were expanded into long tentacular processes. The head had also two lateral expansions, from which projected at right angles the very large and conspicuous oral tentacles. In life the rhinophores were quite simple and fairly long. In the alcoholic specimen they were contracted and somewhat wrinkled. The numerous and thick-set cerata were disposed on peduncles. There was a bare triangular patch behind the rhinophore, and a narrow bare space down the middle of the back, but the cerata folded over the latter so that neither it nor the transverse bare areas were visible. There were about twenty transverse rows of cerata. The first row at the side of the rhinophores consisted of about 10 cerata, much smaller than the rest. After the third row was a distinct gap, and a smaller gap after the fourth. After that the rows were so close together that they could not be distinguished superficially. The innermost cerata were larger than the others, and sometimes bifid : small cerata extended almost to the end of the very short tail.

The jaws were large, with a smooth cutting-edge. The radula consisted of a single series of 13 transparent yellowish teeth of the shape usual in the genus, viz., pectiniform, with large irregular denticles and small accessory denticles. It was sometimes hard to decide whether the rather small denticles should be considered main or accessory; but the average number of main denticles on each tooth was 10, and the largest number (in one case only) 13. The central nervous system was somewhat concentrated. The specimen was only partly dissected.

A new species must, I think, be provisionally created for this animal, though the discovery of intermediate forms may perhaps render its retention unnecessary. In some ways it is itself a connecting-link between *C. longicirra* and *C. annulata*, for the former is said to have 7, and the latter 5 denticles on each side of its teeth, whereas *C. africana* has 4, 5, 6, or 7 indifferently. It can hardly be *C. annulata*, for the difference in colour is too great, and besides there is much less bare space on the back. Neither can it be *C. longicirra*, because (1) the coloration, though similar, is still distinct; (2) *C. longicirra* has the back bare up to the 7th row of cerata, and some of the cerata are very long, which is not the case here; (3) the rhinophores are not perfoliate.

This last point is of some importance for the characterisation of the genus. In the present animal the rhinophores were undoubtedly quite simple in life, and in alcohol they are wrinkled, though it is still possible to see that they are not really perfoliate. In *C. longicirra*, Bergh says the perfoliations are 14 or 15 in number, and not deep. Of *C. annulata* he says that the rhinophores have 12-14 well-marked perfoliations, and that Garrett has wrongly represented them as simple. But in Semper's 'Reisen,' xvii. he states that *C. annulata* var. *affinis* has simple rhinophores, and gives as a generic character: "Die Rhinophorien scheinen nicht perfoliirt zu sein." I have not access to part ix. of his 'Beiträge zur Kenntniss der Aeolidiaden,' which perhaps explains the matter; but it looks as if the rhinophores are simple, but have a tendency to simulate perfoliations when preserved.

PTERAEOLIDIA SEMPERI.

(Bergh, Beitr. zur Kennt. der Aeolidiaden, iii. p. 22, and in Semper's Reisen, Malac. Untersuch. vol. i. p. 18 (1870); under *Elabellina*.)

Four specimens, which seem probably referable to this species, were dredged from 3 fathoms near Chuaka in July 1901. The body is very long, narrow, and vermiform, the largest individual being 5.5 centim. long and only 3 millim. broad. The ground-colour of the body in the living animal is brown, with opaque markings of very light green on the sides and back. The cerata are also dark brown, with numerous thin lines of the same green. The top of the head and the ends of the oral tentacles are opaque yellowish white. The lower part of the tentacles brown, with three rings of

vivid crimson-lake. The body of the rhinophores is brown and inconspicuous, but the tips are whitish and have a crimson ring. Although the colour of the animal when analysed is as described, the general effect in most lights is that it is purple with a silvery glaze.

The specimens were active in their movements, and in particular the long oral tentacles were very mobile. The anterior margin of the foot was produced into two deeply-grooved processes, and its sides projected in two laminae along the whole length of the body. The cerata, which were not at all caducous, were set on fan-like projections of the dorsal margin, from 13 to 20 in number, on each of which were from 10 to 20 cerata. The largest individual appeared to have about 640 cerata in all. None of the cerata were large, but they became more crowded and smaller towards the end of the body, where they extended to the tip of the tail. In three of the preserved specimens there was a very distinct raised border on each side of the back, connecting the fan-like projections, and almost resembling the mantle-edge of Dorids; but in the fourth this remarkable character was not visible. The oral tentacles were very large and long; the rhinophores, which stand between the first clumps of cerata, were small and lamellated, except the tips, which were narrow and smooth. In the individual dissected the radula consisted of a single series of 18 yellowish teeth. The separate teeth were much as represented in Bergh's plate (*l. c.* pl. iii. figs. 5, 6, 7), but somewhat more regular in shape, having nine denticles very symmetrically arranged on each side of a central cusp, but not taking the form of indentations of the cusp itself. The cutting-edge of the jaw bore a row of fine but very distinct denticles, at the side of which were several rows of less distinct accessory denticles. No spine or other armature was discovered in the reproductive system.

These specimens seem to clearly belong to Bergh's genus *Pteraeolidia*. There are some small differences (such as the shape of the rhinophores and of the teeth and the lateral ridges) between them and his description and plates of *Pteraeolidia* (*Flabellina*) *semperi*, but the ridges were absent in one specimen and the other characters were slight. It is possible, however, that a comparison of the living animals might show a specific difference.

ERCOLANIA ZANZIBARICA, n. sp.

(For the genus *Ercolania* see Trinchese, "Un nuovo genere della fam. degli *Eolididei*," Ann. del Mus. di Stor. Nat. di Genova, ii. 1872; id. "Aeolidæ del Porto di Genova"; Bergh, Beitr. z. Kennt. der Aeolidiaden, v. pp. 9-18, Wien, 1878; Vayssièrè, Recherches sur Moll. Opisthobranches, Marseilles, 1888, pp. 121-128.)

Two specimens captured at Chuaka, East Coast of Zanzibar, in February 1901. The living animal was rather more than 2 centimetres long, very fragile and delicate, transparent and of a uniform bright green, the hepatic diverticula in the cerata not

having been distinguished by any difference or intensity of colour. It exactly resembled a piece of the racemose seaweed (*Caulerpa*) on which it was found.

The length of the alcoholic specimens is 2 centim.; the extreme breadth of the back with cerata 8 millim., and of the foot 2.3 millim. The rhinophores are long and distinctly canaliculate. There are no oral tentacles, but two lobes over the mouth. Behind the rhinophores are two very distinct black eyes. The cerata are club-shaped as in *Galvina*, of varying size, the largest inside. On each side of the back are four clumps of about nine cerata each, and there is a thick bunch on the tail, which, however, projects a considerable distance behind the last cerata. Down the centre of the back is a broad bare space, in the anterior portion of which is the very large, elongated (not oval) pericardial prominence. In front of this and fused with it is the vent, a large and conspicuous tube. The foot is rounded in front.

I dissected one specimen, but was unable to obtain a clear view of either the central nervous system or the reproductive organs. The latter, as usual in this family, were extremely complicated, both the prostate and albumen-gland appearing to be extensively ramified. The verge was armed with a small spine. The hepatic diverticula in the cerata, being colourless, were not easy to distinguish, but appear not to be much ramified and to resemble the figure of those in *Ercolania siottii* in Trinchese, pl. ix. fig. 2.

The mouth-parts, buccal muscles, radula, &c. are of the usual ascoglossan type. The teeth are not unlike those of *Ercolania viridis* (v. Bergh, *l. c.* pl. xii. figs. 3 & 4), but the dorsal surface is a simple curve and does not show any depression. The upper portion of the radula contains 6 teeth, the lower 27, the last members being arranged in a spiral like that depicted in Trinchese's plate of *E. siottii* (pl. x A. fig. 1), from which it may be concluded that the individual is young.

As the specimen presents all the characters of the genus *Ercolania*, I describe it under that name, but I feel very doubtful if the genus is valid. The only characters which differentiate it from *Stiliger*, viz. that the rhinophores are canaliculate and the pericardial prominence elongate and not oval, are surely very slight. Vayssi re (*l. c.* p. 122) referred to the genus a species (*funerea*) with entire rhinophores, which is probably in any case a *Stiliger*.

The animal is not likely to be specifically identical with *E. viridis* Bergh, for the coloration is not really the same, the size is much larger, and the shape of the teeth somewhat different.

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ON SOME NUDIBRANCHS FROM EAST AFRICA
AND ZANZIBAR. Part III. By SIR C. ELIOT,
K.C.M.G., H.M. Commissioner for the East Africa
Protectorate, F.Z.S.—Dorididæ Cryptobranchiatæ, I.

[From the PROCEEDINGS OF THE ZOOLOGICAL SOCIETY OF LONDON,
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On some Nudibranchs from East Africa and Zanzibar.
Part III.* By Sir C. ELIOT, K.C.M.G., H.M. Commissioner for the East Africa Protectorate, F.Z.S.—
Dorididæ Cryptobranchiatæ, I.

(Plates XXXII.—XXXIV.†)

This paper contains the results of an examination of a number of Cryptobranchiate Dorids from Zanzibar and the East Coast of Africa referable to Bergh's subfamilies Archidorididæ, Discodorididæ, Diaululidæ, Kentrodorididæ, and Platydorididæ. They include the following species:—

- Archidoris* Bergh.
1. „ *africana*, sp. n.
2. „ *minor*, sp. n.
Staurodoris Bergh.
3. „ *depressa*, sp. n.
4. „ *calva*, sp. n.
Discodoris Bergh.
5. „ *boholiensis* Bergh.
6. „ *cærulescens* Bergh, *variegata*, subsp. n.
Peltodoris Bergh.
7. „ *angulata*, sp. n.
8. „ *aurea*, sp. n.
Thordisa Bergh.
9. „ *villosa* (A. & H.).
10. „ *stellata*, sp. n.
11. „ *crosslandi*, sp. n.

* For Part II. see P. Z. S. 1903, vol. i. p. 250.

† For explanation of the Plates, see p. 385.

Trippa Bergh.

12. „ *areolata* (A. & H.).
 13. „ *monsoni*, sp. n.

Fracassa Bergh.

14. „ *tuberculosa*.

Halgerda Bergh.

15. „ *willeyi*, sp. n. (From the Loyalty Islands.)
 16. „ *wasinensis*, sp. n.

Kentrodorid Bergh.

17. „ *rubescens* Bergh.

Platydorid Bergh.

18. „ *eurychlamys* Bergh.
 19. „ *scabra* (Cuvier).
 20. „ *formosa*? (A. & H.).
 21. „ *elliotti*? (A. & H.).
 22. „ *pulchra*, sp. n.
 23. „ *incerta*, sp. n.
 24. „ *papillata*, sp. n.

Sclerodorid Eliot, gen. n.

25. „ *osseosa* (Kelaart).
 26. „ *tuberculata*, sp. n.
 27. „ *minor*, sp. n.
 28. „ *rubra*, sp. n.
 29. „ *coriacea*, sp. n.

Asteronotus Ehrenberg.

30. „ *hemprichi* Ehrenberg.

The Cryptobranchiate Dorids are distinguished by having branchiæ which are completely retractile into a permanent pocket. The rhinophores also are retractile into permanent pockets and are perfoliate. A radula is always present. In number of species they form one of the richest groups of the Nudibranchiata, but they show less variety of form than the Dorididæ Planerobranchiata, and it is not easy to find good generic characteristics. The most distinctly marked group is that consisting of the large genus *Chromodoris* (with more than 100 species) and some allied genera such as *Casella* and *Ceratosoma*. These possess a characteristic shape, lip-plates, a radula with differentiated teeth, and simply pinnate branchiæ. Well characterised genera are also found in the Miamiradæ (*Miamira*, *Orodoris*, *Sphaerodoris*) and the Cadlinidæ (*Cadlina*, *Tyrinna*). There remain the five sub-families mentioned above, which agree in being usually flat and oblong in form and in having a radula without a central tooth, consisting of numerous laterals which are generally hamate and uniform, though often smaller near the rhachis and degraded or denticulate at the outer end of each row.

Anyone who describes new forms of these Dorids, however much he may disclaim any such ambitious task as a revision of

the group, is bound to consider the value of the existing generic distinctions. The five subfamilies are divided into about 30 genera all created by the great master of the Nudibranchiata, Prof. Bergh, and several of them consisting of a single species. He himself observes (on *Thordisa* in Semper's 'Reisen'*, xv. p. 666) that the definitions of many of these genera seem to be too precise, and as new forms are discovered the old divisions are found to melt away. The discoverer of a new form often finds that it does not accurately fit in to any of the existing genera, and must ask himself whether he should create a new genus or enlarge the definition. I have little doubt that in most cases the latter is the preferable course. If animals are not divided by natural differences, there is no object in emphasising the importance of minute peculiarities. If *Chromodoris* is allowed to consist of 100 species showing a considerable range of variation, including the presence or absence of median teeth, there seems to be a want of proportion in splitting up the other Cryptobranchiata into so many genera.

The genus *Staurodoris* offers a good example of the difficulty of classifying new forms. Taken by itself, the typical species *St. verrucosa* is remarkably well characterised in both the scientific and popular sense. Anyone could recognise it at first sight. The back is covered with club-like tubercles, the rhinophorial and branchial pockets are protected by similar tubercles which act as valves, and the branchiæ are simply pinnate. On the other hand, *St. pseudoverrucosa* (von Ihering) has no tubercles on the branchial pocket and has bipinnate branchiæ. Bergh also refers to this genus the *Doris pustulosa* of Abraham, which has bipinnate branchiæ and small, but apparently not valve-like, tubercles. I have specimens from the Indian Ocean which have the dorsal surface tuberculate and the following additional characteristics:—A. has the rhinophores arising among tubercles and simply pinnate branchiæ, but no tubercles on the branchial pocket (*Staurodoris pecten*). B. has five pinnate gills, the anterior margin of the foot entire, and small tubercles set on the edges of the gill-pocket and partly closing it (*Staurodoris calva*). C. has tubercles round the rhinophores, none on the branchial pocket, and thin bipinnate branchiæ (*Archidoris africana*). D. has tubercles on the rhinophore pockets but not around the branchial opening, and tripinnate gills (*Archidoris minor*). Of these, I think we must admit A. and B. to be *Staurodoris*, if we accept *St. pseudoverrucosa*. But *Archidoris kerguelensis*, *A. australis*, *A. rubescens*, *A. incerta*, and *A. nyctea* are all described by Bergh as having tubercles on the edge of the branchial and rhinophorial pockets, and must come very near the less typical members of *Staurodoris*. It is hard therefore to say whether C. should be classed as *Staurodoris* or *Archidoris*. There seems to be a complete series of links between the two genera, and, this being so, we must either unite

* The letters S. R. in this paper refer to Prof. Bergh's "Malacologische Untersuchungen," published in 'Reisen im Archipel der Philippinen,' von Dr. C. Semper.

the species in question, or draw an arbitrary dividing line. In the latter case, I think we must say that the typical *Staurodoris* has simply pinnate branchiæ and valve-like tubercles closing the rhinophorial and branchial pockets. One or other of these features may be absent or obscure in a species which otherwise possesses the generic characteristics; but when both are absent, as in C., the animal, I think, must be referred to *Archidoris*. Again, *Staurodoris pseudoverrucosa* has the dorsal tubercles sometimes connected by ridges, and the same phenomenon is found in Garstang's *Doris maculata* (which appears to be a *Staurodoris*), and, sporadically, in the true *St. verrucosa*. But, as will be seen from a species described below, *Halgerda wasinensis*, this character brings *Staurodoris* very near to *Halgerda*.

It will be well to examine the value of the chief points by which the subfamilies and genera under consideration can be differentiated. They are as follows:—

(a) The dorsal surface and general texture. The back is rarely quite smooth, as it is in *Chromodoris*; *Halgerda* and *Asteronotus* have the skin smooth but raised into ridges or lumps. As a rule, the surface is covered with projections which may be either minute granulations (*Platydoris*, *Discodoris*, &c.), papillæ (*Thoridisa*, &c.), tubercles (*Archidoris*, &c.), clavate tubercles or warts (*Staurodoris*), compound tubercles (*Trippa*, *Fracassa*). There is sometimes a ridge down the centre of the back. Some genera, notably *Platydoris*, are exceedingly hard; others, such as *Trippa*, are so soft as to be almost gelatinous. On the whole, these external characters of the skin and texture form a fairly good indication of relationship. *Platydoris*, in which I should be disposed to include *Hoplodoris*, forms a distinct natural group, and the warty or tuberculate forms (*Archidoris*, *Staurodoris*) also hang together*.

(b) Rhinophores and branchiæ: Neither the rhinophores themselves, nor the pockets into which they are retractile, seem to offer good generic characters, though they may often serve to distinguish species. But even within a species there may be variety: *Archidoris tuberculata* has the rims of the rhinophore pocket sometimes smooth and sometimes tuberculate.

The branchiæ also are disappointing as a means of classification. For instance, it does not seem possible to unite *Staurodoris* with the other genera having simply pinnate branchiæ (*Chromodoris*, *Casella*, *Ceratosoma*, *Sphaerodoris*, *Halla*, *Thorunna*, *Rostanga*), and these simple branchiæ often show a tendency to divide at the tip and become, strictly speaking, bipinnate. Similarly, we cannot bring together bipinnate forms and oppose them to the tripinnate. Perhaps the distinction between ample and scanty branchiæ will prove to be of generic importance. The branchial pocket is of various shapes: round, crenulate, or stellate. However,

* I find it hard to agree with Prof. Bergh's criticism of his own family Archidoridae that it will prove "ganz unhaltbar und künstlich." With the exception of *Peltodoris* the other forms seem to hang well together.

it does not seem possible to make any classification according to this shape, and to unite, for instance, all the stellate forms.

In most of the Cryptobranchiata the tentacles appear to be digitate, but the Archidorididæ have a tendency (not without exceptions) towards a flattened and furrowed form. *Sphaerodoris* has no tentacles, and the same is said of *Halla* and *Echinodoris*. No part of preserved Nudibranchs is more liable to distortion than the tentacles, which may be variously contracted, flattened, or crumpled by the action of the preserving fluid or the pressure of the adjacent parts.

(c) The foot appears to offer good characters; as a rule, but not invariably, the forms which have a broad foot and narrow or moderate mantle-margin belong in other respects to groups different from those which have a narrow foot overhung on every side by a wide mantle-margin. The Archidorididæ and Discodorididæ have both, as a rule, broad feet, but the body of the former is plump, and of the latter flattened. The Platydorididæ have flat bodies and narrow feet.

In most forms the anterior margin of the foot is deeply grooved, and the upper lamina notched so as to form two flaps, which in the Kentrodorididæ are very ample. Many (though not all) of the Archidorididæ have the anterior margin simply grooved and otherwise entire. In a few genera (*Trippea*, *Halla**, *Sphaerodoris*) the divided upper lamina is attached to the sides of the head, but it does not seem possible to bring together the forms which present this peculiarity.

(d) In the internal anatomy, the mouth-parts are perhaps the most important for classification. It is clear that considerable structural differences in other organs are generally accompanied by a difference in the radula. For instance, *Acanthodoris* and *Lamellidoris*, which bear a strong superficial resemblance to the Cryptobranchiata but have no permanent gill-pocket, have also a totally different radula, and most of the larger divisions of the Nudibranchiata have a characteristic arrangement of teeth. But it is hazardous to conclude from this that *small* differences of the radula have a generic value. One common variation from the ordinary hamate type of radula is the serrulation of the outer teeth. This may be present or absent in the same genus (e. g. *Staurodoris verrucosa* and *St. bicolor*), and in some species (*Platydoris argo* and *Halgerda formosa*†) is only found in some of the rows of teeth. As a general rule the innermost and outermost teeth are smaller: the latter often rudimentary or degraded. But it appears that these characters are only of specific, not of generic importance.

* [I venture to point out that the generic name *Halla* is preoccupied by a Polychæte (Lumbriconereid) worm named by A. Costa in 1844 (cf. Ann. Acad. d. Aspiranti Naturalisti Napoli, ii. p. 63 (1844).—C. CROSSLAND.

† In a specimen of *Halgerda formosa* from the Berlin Museum, given me by the courtesy of Prof. Martens, I found at the end of some but not all of the rows small rudimentary teeth, some but not all of which bore a few irregular serrulations. This is not quite the same arrangement as observed by Prof. Bergh.

Another point of importance is the presence or absence of a labial armature, that is to say, of a ring or plates on the labial cuticle composed of a compact mass of minute hooks or rods. There is some reason for dividing the group into those which possess and those which do not possess this armature, but still I think that an absolute dichotomy of this kind presents difficulties. Firstly, a rudimentary labial armature is of some inconvenience in classification. Bergh has described such an instance in *Platydorís variegata*; and the animal described below as *Thordisa crosslandi* has two small areas on the labial cuticle which cannot be called plates, but consist of a loose collection of minute rods. In *Platydorís pulchra* the labial cuticle is strengthened with similar rods, distributed through its extent, but not collected into rings or plates. Secondly, though *Discodorís* B. is a well-defined genus, the same can hardly be said of the family Discodorididae, the genera of which mostly agree only in having a labial armature. Thus *Fracassa* and *Carminodorís* appear to be akin to *Trippa*, *Hoplodorís* to *Platydorís*, and *Halla* to *Chromodorís*. It would seem that the more primitive forms of the Cryptobranchiata are those which have a labial armature and some differentiation of the teeth, such as occurs in *Chromodorís* and *Cadlina*, and that the forms with no labial armature and uniform hamate teeth are more recent developments. If this be so, it is easy to understand that in many groups a few forms have survived in which the labial armature has persisted. Thus *Fracassa* is practically a *Trippa* which has preserved this character, and it appears to me that its analogies to *Trippa* are greater than those to *Discodorís*.

(e) Considerable use has been made by Prof. Bergh of the reproductive organs as a character for classification*. That great weight must be attached to important variations in these organs—such as the presence of one or two spermathecae—is obvious; but while fully admitting the necessity of examining the internal anatomy and the futility of describing only the external characters of Nudibranchs, it must also be admitted that it is not convenient to found genera of fairly large animals upon minute internal characteristics which can only be discovered by an expert microscopist, and by him only in a well-preserved and mature specimen. Such a criterion seems desirable only if it is of great anatomical importance. But what are the variations presented by these organs in the Cryptobranchiata? (i.) Accessory organs are sometimes present. These are generally accompanied by other characters of systematic importance as in *Kentrodoris* and *Asteronotus*. (ii.) The male branch of the hermaphrodite system sometimes broadens and sometimes does not into a dilatation called the prostate. It does not appear that this difference is generally accompanied by other characters of importance: e. g. a

* But see System. d. Nud. Gast. p. 1088. "Bei dem jetzigen Stande unserer Kenntniss . . . ist es sehr gewagt eine systematische Gruppierung derselben zu versuchen. Es ist es um so mehr als der generische Werth der bei der hier versuchten Gruppierung dem genital System, besonders den verschiedenen Conformationen seiner Ausführungsgänge, beigelegt ist, als solcher kaum sicher gestellt ist."

prostate is present in both *Discodoris* and *Platydoris*, which are otherwise so distinct, and is absent in *Archidoris* but present in *Anisodoris*, which are otherwise identical. (iii.) In many genera is present an armature of the reproductive organs, that is, one or many spines, hooks, or plates generally only on the male branch. The value of this feature, as estimated by the concomitance of other important characters, varies. In the families of Doridopsidæ and Phyllidiadæ and in the well-marked genus *Platydoris* of the Cryptobranchiata an armature is, so far as we know, characteristic. On the other hand, we find two genera like *Diaulula* and *Gargamella* apparently identical but for its presence or absence. In the Aeolidiadæ also a hook or spine is present or absent in closely allied genera. It appears to me that such an armature is not sufficient to constitute generic rank without other characters.

(f) The other internal organs do not offer many features which serve our purpose of classification. It does not appear that we can unite the forms in which the stomach is enclosed in the liver, or in which there is only a single instead of a double blood-gland, or in which the nervous system is very concentrated.

As a result of these considerations, I think that the most profitable way of classifying new Dorids of the group treated of here, is to refer them when possible to the following genera taken in a wide sense:—*Archidoris*, *Discodoris*, *Thordisa*, *Trippa*, *Halgerda*, *Kentrodoris*, *Platydoris*, *Asteronotus*, and *Sclerodoris* (gen. n.). No doubt, remarkable forms have been and will be found which require special genera for their accommodation, but the majority of species seem to me to fall under one or other of the divisions mentioned.

Archidoris is distinguished by a fairly plump shape, broad foot, and a warty or tuberculate back. No member of this group is known to possess a labial armature, and a genital armature is rare. The radula generally consists of uniform, simply hamate teeth: more rarely some or all are denticulate. I include in this genus, in its wide sense at least, *Anisodoris*, *Homoiodoris*, and *Artachaa*. As mentioned above, though it is easy to define the generic characters of a typical *Staurodoris*, the genus seems to pass into *Archidoris* by a complete series of connecting links.

Discodoris. I should be inclined to extend this genus so as to mean flat, oval animals, not hard, with both foot and mantle-brim fairly broad. Back granulate. A genital armature is usually absent; a labial armature is either present (Section *Discodoris*) or absent (Section *Peltodoris*).

Thordisa.—Flat, soft animals, much like *Discodoris*, but with the back neither granulate nor warty, but covered with soft pointed papillæ. No member of this group is known to possess a well-developed labial armature, though a rudimentary one is found in *Th. crosslandi*.

Trippa.—Soft, and sometimes spongy or gelatinous. The back is covered with tubercles which themselves bear smaller prominences or filaments. A labial armature is occasionally present (Section *Fracassa*). Some species have special glands set round the buccal mass, and the sides of the head connected with the foot, but it does not appear to me that the absence of these characters ought to exclude a form from the group.

Halgerda.—The texture is entirely smooth and somewhat stiff, though ridges may be present. In the known species the branchiæ are scanty. No member of this group is known to possess a labial armature.

Kentrodoris.—Broad, soft, and flat, with the dorsal surface minutely granulated. The broad foot is deeply grooved in front, and the upper lip, which is notched in the middle, is developed into wing-like expansions on each side. The reproductive system is sometimes armed, and accessory organs are present. In some species, at any rate, the branchiæ are unusually large.

Platydoris.—Very flat forms, of a peculiar hard consistency. The back is minutely granulated and rough to the touch. The foot is narrow. The branchial pocket is stellate in the known forms. A labial armature is rare (*Pl. variegata*). There is a characteristic genital armature of scales bearing hooks.

Asteronotus.—Of a characteristic leathery consistency. The back is quite smooth in texture, but bears lumps and ridges. No labial or genital armature.

Sclerodoris.—This new genus is proposed for certain forms which appear to have never come into the hands of Prof. Bergh, though I think Alder & Hancock's *Doris osseosa*, *carinata*, *apiculata*, and *tristis* ("Notes on a Collection of Nudibr. Moll. made in India," Trans. Z. S. vol. iii. 1864) should be referred to this genus. It is characterised by having the same hard texture as *Platydoris*, but the back, instead of being smooth, is marked with various ridges and depressions. In the known species there is no labial or genital armature. I should wish to bring my *Sclerodoris* under Prof. Bergh's *Dictydoris*, but the generic characters as formulated by him do not include the hard texture and raised reticulate pattern.

Of the above-named genera, *Asteronotus* and *Kentrodoris*, though well characterised and not rare, have not hitherto proved numerous in species.

1. ARCHIDORIS AFRICANA, sp. n.

One specimen marked "Chuaka, shore." No notes as to living animal.

Alcoholic specimen 5 centimetres long, 1.6 high, with a fairly uniform breadth of 2.7, plump and not flat. The colour is a dirty greyish yellow, with traces of violet. The back is covered with tubercles: those in the middle are largest and measure 4 millimetres across; they decrease in size outwards, and are quite small at the mantle-edge. The top of each is lighter, and

was probably of a different colour in life. It is noticeable that the tubercles in the middle are all large and not mixed with small ones. The mantle-brim is moderately ample, thick, and stiff, and bears numerous irregular tubercles *on the lower side* which are probably glandular in character. The rhinophore openings are indistinctly bilabiate, not much raised, and bear small tubercles on the sides and edges. The rhinophores are large, ample, and deeply perfoliate. The branchial pocket is also not much raised, indistinctly bilabiate, and at the same time with five irregular and not very distinct crenulations. There are tubercles on the sides but none on the edges. The branchiæ are eight, tripinnate, but not ample: the two hindmost are smaller than the others. The foot is large and broad, with a shallow groove anteriorly and a split upper lip. The tentacles, which are set at right angles to the head, are unusually large and long (5 millimetres). The labial cuticle is black, and corrugated but unarmed. The radula consists of 33 rows containing about 60 simple white hamate teeth; the innermost are smaller, but the outermost are much the same size as the rest. No prostate or genital armature was discernible. There was a large purple double blood-gland, deeply cleft in both parts so that it seemed to have four divisions.

2. ARCHIDORIS MINOR, sp. n.

One specimen from Wasin. There are no notes on the living animal.

The alcoholic specimen is 2.9 centimetres long, 1.8 broad, and 9 millimetres high. The colour is rather bright yellow, with traces of a darker tint near the mantle-edge. The back is covered with flat warts, largest towards the centre, and decreasing towards the mantle-edge, but smaller ones are mingled with the larger; they show indications of a lighter colour at the top. The underside is of a uniform yellow. Round the rhinophore pockets are two or three tubercles, which look as if they had been high in life. The rhinophores are high, straight, and narrow, strongly recalling Bergh's figure of those of *Staurodoris januarii* (S. R. Supp. i. plate C, fig. 14). The branchial pocket is slightly raised, bilabiate, and indistinctly crenulate. Though there are tubercles near the edge, these in no sense close over it or act as valves. The branchiæ are eight, tripinnate, but high, thin, and scanty. The central papilla, also, is very high and thin. The foot is fairly broad, and grooved in front, with the upper lamina notched. The tentacles are small and conical. There is no labial armature. The radula consists of 30 rows, each containing about 50 long hamate teeth on either side of the rhachis; the innermost are crowded and smaller, the outermost not much smaller. At the side of the base is a groove, terminating in a slight projection at the bottom of the hook.

This specimen has many points of resemblance with *Archidoris africana*, but I am inclined to think that it is specifically distinct, for the following reasons:—(1) The prevailing colour is yellow,

whereas in *A. africana* it is violet, both externally and in the intestines; (2) the tentacles are small; (3) there are no tubercles on the underside of the mantle-edge; (4) the rhinophores and their pockets are somewhat different from those of *A. africana*; (5) so are the teeth.

It is possible that this is the *Doris rusticana* of Alder & Hancock ("Notes on a Collection of Nudibranchiate Mollusca made in India," Tr. Z. S. iii. p. 120), but in view of their statement "No oral tentacles (?); the head with lateral angles; branchial plumes five," identification is not possible.

3. STAUDODORIS DEPRESSA, sp. n.

One specimen from Wasin. No notes as to living animal.

The alcoholic specimen is 6.3 centimetres long and 4.9 broad. The general shape is broad and flat. The thick and fleshy mantle-brim is 2 centimetres wide, and the foot consequently unusually small compared with the dorsal surface, being only 2.7 mm. long and about 8 mm. broad. The colour is a uniform greyish white, with a slight tinge of violet anteriorly and down the middle of the back. The whole upper surface is covered with warts, which are small at the mantle-edge but increase in size towards the centre. The top of the larger ones, which measure 5 millimetres across, is flat and hard, consisting of a mass of densely-crowded spicules, and is of a somewhat different shade from the rest and in life possibly distinctly coloured. On the underside of the mantle-edge are numerous small tubercles of glandular appearance. The openings of the rhinophores and branchiæ are tuberculate. The latter orifice is indistinctly stellate and also indistinctly bilabiate, but it is not clear what its original shape may have been. Both the branchial and rhinophorial orifices are closed in the alcoholic specimen. The branchiæ are six in number, but the hindermost pair are deeply bifid so that there appear to be eight. They are mostly bipinnate and rather scanty. The foot is grooved and notched in front. The tentacles are large, distinct, and somewhat flattened, with rather uncertain traces of a groove. There is no labial armature. The radula is broad and white, the formula being about $70.0.70 \times 32$. The teeth are simply hamate and all of much the same size. On some of the inner ones I was able to see eight or ten very minute denticles on the inside of the hook. This extremely fine serrulation is difficult to detect, but I expect that it is present on all the teeth except the outermost. The stomach is not free, but is enclosed in the liver. The female reproductive organs are armed with small transparent brick-like scales.

This form offers analogies to both *Homoiodoris* and *Artachara* Bergh, particularly the latter, and the thick leathery mantle and large warts also remind one of *Asteronotus*. On the whole I class it, though very doubtfully, as *Staudodoris*, mainly because the openings of the rhinophores and branchiæ are closed by the surrounding tubercles.

4. *STAURODORIS CALVA*, sp. n.

One specimen from Kokotoni Harbour, Zanzibar; dredged in about 5 fathoms.

The living animal was of a dirty grey colour, but with very little pigment at all; the gills and rhinophores sandy, the under surface and the smooth band near the rhinophores pinkish. The dorsal surface was covered with tubercles, large and small, of various sizes, but decreasing towards the mantle-edge, where they were minute; small tubercles were set on the edge of the slightly raised gill-pocket, which was partly closed by them. The anterior portion was prolonged into a nose-like projection. Across it extended a smooth pinkish strip, which bore no tubercles. Immediately behind this strip were set the rhinophores. It is possible that this singular arrangement may have been an unnatural distortion. Some species of *Platydoris* undoubtedly remain fixed in crevices until their shape is altered. Still, the present specimen showed no trace of tubercles having been effaced on the bare patch, and there is no reason to suspect the character except that it is, as I believe, unique among the Dorididae.

The alcoholic specimen, 2 centimetres long and 1·3 broad, is much like the living animal. The broad foot has the anterior margin entire and not grooved. The dorsal tubercles are surrounded by numerous very distinct spicules arranged in a stellate form. The tentacles are small and furrowed. There is no labial armature, and the radula consists of 48 rows of simple hamate teeth containing about 70 teeth on each side of the rhachis. The stomach is large and free. The branchiæ are five in number and bipinnate. The branchial pocket is almost closed by the valve-like tubercles on the edge of it. No reproductive armature was discovered.

This form seems referable to *Staurodoris*. Though the branchiæ of this genus are typically only pinnate, they appear to be bipinnate in both *S. pseudoverrucosa* (v. Iher.) and *S. pustulosa* (Abr.).

5. *DISCODORIS BOHOLIENSIS* B.

[S. R. xii. p. 519, xvii. p. 897.]

Two specimens from Zanzibar.

The body of the living animal was flat, with a very ample flexible mantle. A high, narrow dorsal keel extended from the branchial pocket to between the rhinophores. The ground-colour was yellowish drab, with a black edging round the wavy mantle-edge, which in places extended inwards. The whole back was covered with small papillæ, some brown, some white. The dorsal keel was blotched with brown and black. The rhinophores and branchiæ were black. The underside was dirty white, with black and brown blotches at the side of the foot. The living animal was 2½ inches long and 2 broad. The large specimen displayed the phenomenon of self-mutilation. The rhinophore openings

were raised and crenulate, the rhinophores bent backwards. The branchial opening is a transverse slit, the two lips almost meet in the middle but separate at the sides. The branchiae are six, tripinnate, the posterior pair bifid. The labial cuticle bears two small yellowish plates composed of minute rods. The radula formula is about $23 \times 40.0.40$. The teeth are simply hamate; the two or three outermost are rudimentary, the innermost are smaller and have rather shorter hooks as described by Bergh.

6. *DISCODORIS CÆRULESCENS VARIEGATA*, subsp. n.

[Bergh, in Semper's Reisen, xvi. Hälft i. p. 805.]

One specimen from Jembiani, Zanzibar.

The living animal was about an inch long and of a light slaty blue, with many small blackish blotches. The coloration of the underside was similar but rather lighter.

In alcohol the blue parts have become yellow, a remarkable change of tint which has also occurred in *Trippa monsoni*. The texture is leathery and stiff but not hard. The whole dorsal surface, including the rims of the rhinophore and gill-pockets which are raised, is covered with minute tubercles. The branchial pocket is roundish, with a jagged edge and very deep. Within it are six tripinnate branchiae. The foot is grooved and the upper lip deeply cleft. Immediately above this cleft is the mouth, with a white, tapering, digitate tentacle on each side. In the upper part of the oral tube are two roughly triangular collections of minute rods, less definite in outline and consistency than the type of armature generally described as labial plates, but sufficiently large to warrant us in describing the cuticle as armed. The radula consists of 30 rows, containing about 45 white, simply hamate teeth on each side of the rhachis. The innermost and outermost are somewhat smaller, but not degraded in shape. The reproductive system is not armed. The prostate is bent and fairly large, but I was not able to discover the peculiar structure of the hermaphrodite gland mentioned by Bergh.

This animal appears to have all the chief characteristics of Bergh's *D. cærulescens*, and comes from much the same part of the world. Möbius's specimen (from Mauritius) was apparently of a uniform bluish white, whereas this one is mottled with darker blotches. Hence I describe it as a variety.

7. *PELTODORIS ANGULATA*, sp. n.

One specimen from Chuaka.

The animal has a close superficial resemblance to *Thordisa villosa*, but has six violet-brown spots symmetrically arranged in rows of three on each side of the median dorsal line between the rhinophores and branchiae, and some round chocolate spots on the under edge of the mantle near the foot. The violet spots seem to be under the surface and visible through the dorsal skin. On a closer examination the superficial resemblances disappear:

the peculiar tubercles of *T. villosa* are absent; the general texture, though flexible, is not quite soft, but rather stiff; the back is minutely granulate but not harsh. The rhinophore pockets are raised and have jagged edges. The branchial pocket is raised with round smooth edges, turned very distinctly outwards. The branchiæ are six and tripinnate. The anterior pair are smaller than the others. The most characteristic feature of this specimen is the foot, which has a wide thin margin all round, dilated anteriorly into tentacular expansions, similar to those found in the Aeolididæ, and 3·5 millimetres long. The front part seems to be grooved in the middle and the upper lamina to be attached to the head on each side. Admitting that it is dangerous to speak positively of such characteristics on the strength of a possibly distorted alcoholic specimen, I think it is clear that the anterior portion of the foot must be expanded in a way unique among the hitherto described species of Dorididæ. The tentacles are thin and digitate. No labial plates were discernible. The buccal mass was large for the size of the animal. The formula for the radula appeared to be about $45.0.45 \times 38$. The teeth are the ordinary simple hamate type; the innermost are not smaller; the 3-5 outermost are degraded but are not serrulated. The stomach is large and free, laminated internally. There seemed to be traces of an inconspicuous armature of transparent scales on the glans, but I was not able to satisfactorily make out its arrangement.

The dorsal spots in this specimen seem to resemble those described by Bergh in *P. mauritiana*, but this animal must be specifically distinct from that form.

8. PELTODORIS AUREA, sp. n.

Three specimens captured near Wasin.

The living animal is flat, with an ample mantle which extends far beyond the head and tail. The texture is not hard but also not flabby; one specimen is much stiffer than the others. The general colour is a rich light orange, due to the back being covered with little flat orange warts on a sandy ground. At regular intervals round the mantle-edge are spots of dull violet; there is also a spot just in front of the gills and one behind the rhinophores. The under-side is yellowish with a few brown spots. The dimensions are 2·2 centimetres length, and 1·4 centimetres breadth. Both the rhinophore and gill-pockets are somewhat projecting, but though they rise among tubercles they cannot be described as tuberculate. The gill-pocket is large, somewhat contracted in the middle and expanded at the sides, so that the 8 tripinnate gills fall in two bundles, right and left. The foot is 1·6 centimetres long and only 3 millimetres broad; grooved and notched in front. The tentacles are small and button-like. There is no labial armature. The radula is small and fragile: it consists of twenty rows, each containing about 25 white, simply hamate teeth; the innermost and outermost are somewhat, but not conspicuously smaller. The

stomach is quite free from the hepatic mass. No armature was discernible in the reproductive organs.

I have some hesitation in classifying this specimen as *Peltodoris*, as the back is not minutely granulated but covered with small warts. The shape, however, is not that of *Archidoris*, and both the stiffness and small radula are in favour of the position here assigned to the form.

9. *THORDISA VILLOSA* (A. & H.). (Plate XXXII. figs. 1 & 2; Plate XXXIII. figs. 1-3.)

[Alder & Hancock, Trans. Zool. Soc. Lond. vol. iii. (1864) p. 119, pl. xxxiii. fig. 1; Bergh, Semper's Reisen, Heft xii. (1877) p. 540; Bergh, Danish Exped. to Siam, Opisthobranchiata, 1902, p. 182.]

One specimen was dredged in Zanzibar Harbour on a sandy bottom with a little *Zostera* (Pl. XXXII. figs. 1 & 2). The ground-colour of the living animal is a translucent yellow, like a bit of crystallised fruit. On the ample and transparent mantle-margin were blotches of peaty red and of different sizes. Smaller spots of the same colour are scattered over the whole body, particularly above the visceral mass. The under surface is uniform bright yellow with a few brown dots. The whole dorsal surface is covered with colourless transparent papillæ (Pl. XXXIII. fig. 2), some simple (especially on the mantle-edge), and some compound with two or more filaments. It is also plentifully supplied with spicules set in a stellate arrangement, but the general consistency is quite soft and not stiff. The rhinophore and branchial openings are slightly raised and tuberculate, but not stellate. The rhinophores are large and slightly bent back; the stalk is rather longer than the laminated portion. The branchiæ are six and mostly only bipinnate, though tripinnate branches also occur (Pl. XXXIII. fig. 3). They are grey with a brown rachis. The foot is grooved in front but not notched. The tentacles are thin and digitate. There is no trace of labial armature. The radula consists of about 47 rows of simply hamate teeth, each row containing 40-50 on either side of the rachis. They are all of the same shape and size, except the outermost five or six, which bear from seven to ten long fine hair-like denticles on each side of the much reduced central hook. No armature was discoverable in the reproductive system.

The alcoholic specimen is quite flat, and is 2.5 centimetres long by 1.6 broad, but the living animal was capable of assuming two shapes—one flat with a broad mantle-edge, and one high with a much narrower edge (Pl. XXXIII. fig. 1).

I think this animal may be safely identified with the *Doris* (*Thordisa*) *villosa* of A. & H. Bergh seems to think that this species is probably identical with his *Thordisa maculigera*, and I share this view, though the formation of the outermost teeth is not exactly like either his description or his plate, as the denticles are longer and the central hook, though much reduced, has not vanished.

10. *THORDISA STELLATA*, sp. n.

One specimen from Chuaka.

The living animal was soft, but yet distinctly harsh to the touch. The colour is a yellowish grey with small sandy patches and also dull chocolate blotches, the latter at the mantle-edge and round the visceral mass. The underside is of a greyish white, with pronounced chocolate blotches round the foot, and a much fainter ring of the same halfway to the mantle-edge.

The preserved specimen, which is much bent, is 2·8 centimetres broad, and would be at least 3·5 centimetres long if straightened out. The texture is rather leathery, but the back is covered with small soft papillæ of various sizes and colours, and all simple. The rhinophore-openings are slightly raised, closed, and apparently crenulate. The branchial pocket is slightly raised, stellate, and entirely closed by six lobes. The branchiæ are yellow, tripinnate, five or six in number according as one much smaller than the others is reckoned separately or as an appendage. The rhachis is very thick and broad. The foot is grooved and notched in front. The tentacles are close together above the mouth and somewhat flattened. No labial armature could be found. The radula consists of 36 rows, each containing about 70 hamate teeth of the ordinary type. The innermost are smaller and the outermost less distinctly formed, but neither rudimentary nor denticulate. No genital armature was discoverable.

This specimen appears referable to *Thordisa* and bears a strong resemblance to *T. villosa*, but differs in the more leathery consistency, the stellate branchial opening, and the outermost teeth of the radula.

11. *THORDISA CROSSLANDI*, sp. n. (Plate XXXII. fig. 3 & Plate XXXIII. figs. 4-8.)

Many specimens of this form were captured at Chuaka, on the East Coast of Zanzibar, in 1901-02.

The animals are large, the measurements of a fine alcoholic specimen being, length 12·5 centimetres, breadth 9·1, height 2·5. The shape is therefore flat and oval. The coloration is in its general effect inconspicuous. The upper surface is sandy with blotches of brown irregularly bordered with black. The under surface (Pl. XXXIII. fig. 3) is whitish with numerous brownish spots and a brownish border. But when the upper surface is carefully examined it presents a great variety of shades of light and dark brown which cannot be easily described or depicted. The back is covered with thick-set pointed papillæ, some of which are developed into distinct filaments at their extremities. The general texture is soft. The openings for the rhinophores and branchiæ are slightly raised, and may be described as tuberculate since they open among tubercles, but they do not appear to be provided with special tubercles. The branchial pocket is an irregular oval and not stellate or crenulate. The branchiæ (Pl. XXXIII. fig. 5) are six in number and tripinnate. The

rhinophores are bent backwards. The foot is fairly broad: it is grooved anteriorly, and the upper lamina is notched and developed into fairly ample flaps on each side of the division. The oral tentacles are digitate, and white with yellow ends. On the white labial cuticle are two small yellow patches, measuring 1 millimetre in length in the largest specimens. They are composed of an irregular collection of rods, similar to those which form the labial armature of the Discodorids, but can hardly be described as plates since the outline is ill-defined and the texture loose. The radula consists of about 45-55 rows, containing about 80 teeth, on each side of the naked rhachis, over which the innermost teeth close so as to render it invisible. The teeth (Pl. XXXIII. fig. 4, *a* & *b*) are of the ordinary hamate shape and all alike, except that the innermost are distinctly smaller. At the outer end of some, but not all the rows, is found a small degraded tooth. The stomach is free from the hepatic mass, and the lower part is somewhat muscular and laminated internally. The genitalia are remarkable for the structure of the glans (Pl. XXXIII. figs. 6 & 7), which is long, twisted spirally, and provided with two rows of tubercles. The central nervous system (Pl. XXXIII. fig. 8) is much concentrated, as in *Asteronotus*, and the different ganglia cannot be distinguished.

All my specimens were found adhering to the underside of stones in a manner suggestive of sedentary habits. The animal is able, however, to swim well upon occasion with a motion somewhat resembling that of a sole. It has also some power of self-mutilation, and can cast off portions of the mantle, though it does so less readily than some allied forms. The branchiæ are very sensitive, and retract if the shadow of a hand is allowed to fall on them. The dorsal papillæ are kept in constant motion.

It is extremely difficult to determine the true affinities of this species. It has the general form and soft pointed papillæ of *Thordisa*, and to that genus I think it had better on the whole be referred. But it has also a rudimentary labial armature, a concentrated nervous system, and a peculiar conformation of the genitalia. In this last point it offers some, but not complete, analogies to *Phialodoris*, in which, however, the back is minutely granulated and not covered with papillæ.

12. TRIPPA AREOLATA (A. & H.).

[A. & H., "Notes on a Collection of Nud. Moll. made in India," Tr. Z. S. iii. 1864, p. 119.]

Two specimens, one from Mombasa, the other from Wasin.

Alder and Hancock's figure gives a good idea of the living animal, but hardly emphasises sufficiently its extraordinary resemblance to a piece of old worm-eaten sponge. Though conspicuous enough when placed by itself in a basin, it is invisible in its natural haunts, among sponges and seaweeds. Both my specimens were detected by touch only, not by sight, and I suspect that the creature is really common.

The living animal was spongy and almost gelatinous in texture. The alcoholic specimens though flabby have become considerably shrunk and hardened. The larger one (to which all the measurements given below refer) is 5·7 centimetres in length, 3·8 in breadth, and 2·3 in height. Down the centre of the back runs a somewhat indistinct ridge, on each side of which is a row of five pits, with black bottoms. There is one similar pit behind the branchial pocket. In the smaller specimen the distribution of the pits is different, and it would appear that no particular arrangement can be regarded as characteristic of the species. In this specimen also the dorsal ridge and a knotty crest between the rhinophores are much more distinct than in the larger one, bearing out Alder and Hancock's remark that these features are most conspicuous in the young individuals. In both specimens the back is covered with irregular tuberculate warts or prominences. The rhinophores project out of tubes which are about 5 millimetres high and thickly studded with tubercles, about five being set round the edge. The branchial pocket projects about 6 millimetres and opens backwards. In the larger specimen it is distinctly bilabiate. The upper lip is thickly tuberculate in its whole extent and bears three compound tubercles on its edge which close like a valve; the lower lip has no tubercles on the edge and is altogether smoother than the other. In the smaller specimen the pocket opens backwards, but is round and not two-lipped. It is probable that the tubercles increase in number and size as the animal grows older. The branchiæ are large and strong, tripinnate, and apparently five in number, but so deeply bifid that it would hardly be wrong to call them ten. In both specimens the foot is deeply grooved and notched in front and the upper lamina united to the head below the mouth, an arrangement which differs from that seen in *Sphærodoris (lævis)*, where the mouth seems to be between the two laminae.

The labial cuticle is very strong and much puckered, but no armature was discernible. Round the buccal mass, at the posterior end of the oral tube, are set a number of glands, of which I found ten in one specimen and eight in the other. They are mostly three-fingered in shape. The radula consists of only 23 rows, each containing about 40 teeth on either side of the naked rhachis, but looks large and broad on account of the unusual size of the teeth, which are simply hamate with yellowish bases and colourless hooks. The innermost teeth are very small, but gradually increase in size up to the 15th, after which they are equal. The two or three outermost are reduced. The stomach is small but free. No armature was discernible in the reproductive organs.

I think these specimens are clearly the *Doris areolata* of A. & H., and equally clearly referable to the genus *Trippa*, Bgh. Probably *Doris spongiosa* Kelaart (Ann. Mag. Nat. Hist. (3) iii. 1859, p. 303) is the same species. *Trippa (Phlegmodoris) nephitica* Bgh. is a closely allied form, and I should not be surprised if it even turned out to be a variety of, or identical with,

this species, for these animals evidently undergo great changes, both of shape and colour, in alcohol.

13. *TRIPPA MONSONI*, sp. n. (Plate XXXII. fig. 4.)

One specimen dredged at Chuaka on the East Coast of Zanzibar.

I made the following description of the living animal:—About one inch long and lively in its movements. The mantle ample, covering both foot and head completely. The foot narrow, grooved in front and slightly notched on the upper lip. The tentacles on each side of the mouth white and conical. The whole body is of a soft, spongy texture. The back is covered with small purplish-white prominent reticulations and also bears white tubercles, particularly on the edges of the mantle, branchial and rhinophore pockets. Both the tubercles and reticulations bear small papillæ or bristles. Between the reticulations are small purple pits and, as a result, the general colour seems purple. Besides these, there are four large pits, set symmetrically in a square in the centre of the back. They are brownish at the sides and deep purple at the bottom. There are five other similar but rather smaller pits, three in front of the rhinophores, one behind the gills, and one placed quite symmetrically at the side of the upper right-hand large pit. A white line runs round the edge of the mantle. The rhinophores are yellow and finely perfoliate. The gills are usually exposed, though they are completely retractile into a rather small pocket. They are six in number, yellowish and tripinnate. The under surface of the animal is purplish white; there are no spots on the foot, but two rows of purplish blotches on the underside of the mantle.

The alcoholic specimen is 1.1 centimetre long and .5 broad. It is very spongy, like the living animal, but the colour has changed to a uniform light yellow, Only the four central pits remain distinct, the others having disappeared. There is no labial armature. The radula consists of 28 rows of hamate teeth, bearing three very small triangular denticles on the side of the hook. The innermost teeth are small and less distinctly formed than the others; the three or four outermost are rudimentary, and sometimes bifid or trifid. There is no genital armature.

I think this form may be referred to *Tripa*: the spongy texture, the pits, and the small internal teeth all seem characteristic. In making the dissection, I unfortunately omitted to search for the ptyaline glands, and am now unable to say whether they are present or not.

14. *FRACASSA TUBERCULOSA*, sp. n.

One specimen from the East Coast of Zanzibar on the reef.

The living animal was of a dirty-white colour with dull green patches on the centre and edges of the back; the whole upper surface was sprinkled with small bright blue dots with chocolate borders; also there were several dull yellow spots. The under surface was white with an irregular and indefinite network of dull green. The junction of the foot with the under surface of the mantle

was marked by a thick line of chocolate with numerous small bright blue blotches. The dorsal surface was arched and covered with large irregularly shaped tubercles bearing secondary knobs.

The alcoholic specimen is of a uniform greyish white. It is 4.7 centimetres long, 2.9 broad, and 1.9 high. The margins of the rhinophore-pockets are raised and smooth. The branchial pocket is not much raised and in itself forms a fairly regular circle, which is, however, somewhat distorted by the surrounding tubercles. The margin, however, is not tuberculate as *e.g.* in *Staurodoris*. The branchiae are eight and tripinnate, the anterior pair being much larger than the others. The anal papilla is large. The spots at the junction of the foot and mantle appear to be glandular. The foot is grooved and notched in front. On each side of the mouth are two small conical tentacles. There is a labial armature of two small yellowish plates composed of minute rods. The short but very broad radula consists of only 28 rows, containing about 65 yellowish teeth on each side of the rhachis. The teeth are hamate; the innermost fold over the rhachis: there is an accessory denticle in the four or five outermost, and the outermost of all are smaller and rudely formed. The reproductive system is unarmed; there are ample folds surrounding the orifices and a prostate is present.

15. *HALGERDA WILLEYI*, sp. n. (Plate XXXII. fig. 5.)

One specimen captured by Dr. A. Willey, at Lifu, Loyalty Islands, and kindly given by him to me, seems referable to this genus. It was accompanied by a drawing (*vide* Pl. XXXII. fig. 5) and this note:—"Lifu, Sandal B., 3.10.96. Reddish yellow (rich ochreous) ribbed Doris. The ribs are ochreous and intervening valleys have black linear pigment. Tentacles (*i.e.* rhinophores) white tipped with black girdle. The rest of ground-colour is dull greyish black. Cloacal rim a dirty white. Foot orange, produced behind. On passing the hand over branchiae so as to produce a shadow they were retracted." I have captured an Ophiuroid at Zanzibar, the coloration of which exactly resembled Dr. Willey's drawing, so that it is possible that this remarkable pattern may be cryptic in certain surroundings.

The preserved animal is considerably shorter and broader than the drawing. The length is 3.1 centimetres and the breadth 1.8. The general shape is flat; the foot long and narrow (2.3 centimetres long by .5 broad), grooved but not cleft in front. The mantle-margin is thin but ample, though a large piece has apparently been bitten out behind. The general consistency is tough and leathery, but there is no rough feeling as in *Platydoris*. Though smooth to the touch, the back is covered with a series of low ridges and valleys arranged in an elaborate pattern, which will be best understood from the figure (Pl. XXXII. fig. 5). It starts partly from the mantle-edge and partly from the median dorsal line, by which it is divided into two parts, though there is no raised crest. On the dorsal surface the ridges are yellowish brown and the valleys black. On the lower surface the coloration is much the same, there being

numerous black lines instead of valleys. The tentacles are knob-like but large and distinct. The rhinophore-openings are quite smooth, whitish yellow, and fairly large; they are flattened, but look as if they had once projected. The branchial pocket is fairly large, quite smooth, and whitish yellow. The rim is thin but projects amply. The direction of the opening is posterior, not vertical. The branchiæ (as shown in the figure) consist really of two plumes arising one on each side of the anal papilla, but each is split into three subdivisions, so that there appear to be six. They are scanty and irregular; mostly bipinnate, but partly tri-pinnate. The buccal parts are protruded and are yellowish white with black spots. There is no trace of labial armature. The radula consists of whitish and simply hamate teeth; the outermost are not denticulate or degraded; the innermost are smaller and more crowded than the others. On the left side under the mantle is a curious gland-like projection, which is perhaps merely a blister caused by alcohol. On the right side in the usual place is a large yellow lump with black spots on which are placed the genital orifices; they are surrounded by strong folds, but no armature was discoverable in the organs themselves.

I propose to call this species *Halgerda willeyi*.

16. HALGERDA WASINENSIS*, sp. n. (Plate XXXIV. figs. 1 & 2.)

Three specimens captured by Mr. Crossland at Wasin Island, East Africa.

They differ from *H. formosa* and *H. willeyi* in having not only a pattern formed of ridges on the back, but also distinct knobs at the points where the lines of this pattern join one another.

In the living animal (Pl. XXXIV. fig. 1) the mantle-edge was white, but the ground-colour was a dull red-brown; numerous brown spots of a deeper colour were arranged round the mantle-edge and a few scattered over the central dorsal area. Over the whole dorsal surface was a raised pattern in brilliant orange. The white foot was also spotted with deep reddish brown. This colour also appeared on the rhinophores in broad bands alternating with white, and in broad lines on the rhachis of the white gills. The foot projected behind the mantle in crawling.

The largest alcoholic specimen is 1.9 centimetres long, 1.2 broad, and .7 high; the contracted foot is 1.4 long and .4 broad. Traces of the original colour remain, but the yellow has mostly disappeared. The raised network starts from a central ridge and is developed in a pattern composed of roughly triangular spaces. The foot is 1.2 centimetres long and only 3 millimetres broad; the tail is 5 millimetres long. The anterior margin of the foot is grooved and the upper lip notched. No oral tentacles are visible, but in all the specimens the head is so contracted that it would be unsafe to say none exist in life. The rhinophore-openings are set in a tubercle and are very difficult to see. The rhinophores are long, but only a small part is lamellate. The branchial pocket is quite

* This name is wrongly spelt "*wassinensis*" on Plate.

round, very small, with a thick white rim round it, so that in the preserved specimen it resembles a dorsal tubercle. The bipinnate branchiæ are somewhat scanty and irregular; they are arranged as in the diagram (Pl. XXXIV. fig. 2), the three posterior plumes being quite small. There is no labial armature. The radula consists in one specimen of 18 and in another of 24 rows; in both specimens the longest rows contain 26 teeth on each side; the rows bend downwards near the rhachis, the ten or twelve innermost teeth being smaller and more crowded than the others. All are simply hamate except the outermost. These are rudimentary; sometimes they bear three or four long denticles and sometimes seem to be split up into small separate rods. There is no trace of any armature in the genital apparatus; the organs are small and possibly even the largest specimen is immature.

This form presents resemblances to *Staurodoris*, some species of which have bipinnate branchiæ, but the dorsal tubercles are few, and none are present round the pockets of the branchiæ or rhinophores, both of which openings are differently formed from those of *Staurodoris*.

17. *KENTRODORIS RUBESCENS* B. (Plate XXXIV. fig. 7.)

[Bergh, S. R. x. p. 411.]

Several specimens were obtained at Chuaka in August 1901. The distribution was apparently very local and the species was found only on this one occasion. The alcoholic specimens have unfortunately been lost, but I give a figure drawn from the living animal and the following notes:—

The animal was large (about 17 cm. long and 5 broad), soft and almost gelatinous. Its most remarkable feature was the great size and elevation of the seven quadripinnate gills, which were retractile into a large cup. Their tips were as much as 8 centimetres above the level of the back. The mantle projected anteriorly and formed an ample loose hood over the head. The ground-colour was a light pinkish drab with dull yellow spots and brown blotches dorsally. There were also a number of thin chocolate lines running more or less longitudinally but often branching laterally. The under surface was of a light drab-brown, with similar chocolate lines on the foot. The dark colour of the gills was due to a multitude of such lines.

The animals were infested by a number of yellow parasitic Copepoda.

I think this animal is Bergh's *Kentrodoris rubescens*, though, as the specimens are unfortunately lost, it is hard to be quite sure. The huge erect gills are even a more prominent feature here than in Semper's figure (*loc. cit.* pl. xxxiii. fig. 8).

18. *PLATYDORIS EURYCHLAMYS* B.

[Bergh, S. R. xii. p. 510, Suppl.-Heft i. p. 61, xvi. p. 802.]

Two specimens from Chuaka.

According to notes made from the living animal, the texture was hard and rough. The larger specimen was 8 centimetres long

and 4.5 broad. The dorsal surface was covered with reddish-brown granulations, each surrounded by a grey or white ring, and there were also in one specimen eight chocolate-coloured blotches with white edges, four around the rhinophores and four in front of the branchial pocket. The rhinophores were dark brown, the gills grey, with a thin white line down each pinna. In the smaller specimen (which appeared to be indubitably the same species) there were no blotches and the gills were drab-coloured. The blotches have also vanished from the alcoholic specimen, which is of a dull reddish brown, darker in places owing to aggregations of minute black spots. The under surface is of a uniform reddish brown. The texture is hard and rough, as usual in the genus. The visceral mass is 3.2 centimetres high and arched, but the mantle-margin is low and flat. This margin is exceedingly ample, measuring as much as 2.6 centimetres at the sides, 2.2 behind the tail, and 1.7 before the head, although the dimensions of the whole alcoholic specimen are only 6.9 by 6.1. The small foot is grooved and notched in front but not very deeply. The rhinophore-pocket is slightly raised and crenulate. The branchial pocket is entirely closed by six lobes. The anterior and posterior lobes are broad flaps, and considerably larger than those at the side, which are narrow and pointed. The gills are six, tripinnate, not very large or very sensitive. There is no labial armature. The radula was injured, but was clearly large and composed of closely-packed simply hamate teeth. Perhaps the formula may have been about $50 \times 100.0.100$. The innermost teeth are smaller than the rest; the outermost irregular in shape. The stomach is large and free, thin, and only partly laminated. The large double blood-gland is partly anterior and partly posterior to the central nervous system. There is a genital armature of discs and hooks as described by Bergh.

19. PLATYDORIS SCABRA (Cuv.).

Three specimens from Wasin.

The alcoholic specimens have preserved the hue of the living animal unusually well. The ground-colour is yellowish white, with irregular violet mottlings of varying intensity formed mostly by minute rings of the same colour with yellowish-white centres or by spots. The underside is a clear yellowish white, with no markings except at the sides of the foot which are mottled like the back. The branchiae are light yellow with grey axes; the rhinophores, buccal mass, and viscera all light yellow, and there is a thin rim of the same colour round the pockets of the rhinophores and branchiae.

The largest specimen is 9 centimetres long, 5.2 broad, and 2.2 high. The visceral mass is somewhat arched and the wide mantle-margin undulated. It is 1.9 centimetres broad at the sides, 1.5 in front of the head, and 1.2 behind the tail. The foot is small and narrow; it is grooved and notched in front but not very deeply, and the upper lip is thick. The branchial pocket has six lobes, as in *Platydorís eurychlámýs*, the anterior and posterior lobes being

larger than the others. The branchiæ are six, tripinnate, very ample and delicate. The tufts at the side of the posterior pair are almost separate, so that the whole number might be reckoned as eight. The rhinophore-pockets are closed by indistinct crenulations. The oral tentacles are of a fair size, white and conical. There is no trace of labial armature. The radula formula is about $48 \times 60.0.60$. The teeth are simply hamate, the innermost smaller, the two or three outermost irregular. The penis is armed with the hamiferous disks characteristic of the genus apparently set in four rows, and the vagina provided with strong folds.

The animal, both when alive and when preserved, is exceedingly hard and rough. It is very sluggish, and I have always found it fitted into crevices on the underside of stones, as if it had not moved for a long period.

20. *PLATYDORIS FORMOSA* ? (A. & H.), var.

[Alder & Hancock, "Notes on a Coll. of Nudibr. Moll. made in India," Tr. Z. S. iii, 1864, p. 116.]

One specimen from Chuaka.

The notes on the living animal describe it as bright scarlet, shaded in places by minute brown specks, very flat, and rough to the touch all over. The end of the mantle had been thrown off, probably by self-mutilation, so that the body terminated abruptly behind the gill-pocket.

The alcoholic specimen is much bent, but if straightened out would be about 5 centimetres long; the maximum total breadth is 4 and the maximum width of the mantle-margin 1.4. The somewhat projecting rhinophore-pockets have slightly crenulate edges, as has also the branchial pocket, which is nearly round. The branchiæ are six, tripinnate, and rather small. The foot is somewhat broader than usual in the genus, grooved and notched in front. The oral tentacles are large and slightly grooved on the outer side. The buccal mass is very large and muscular. There is no labial armature but a large dark radula, consisting of simply hamate teeth, the innermost smaller, the outermost irregular in shape. The formula is about $60.0.60 \times 40$. The genital organs are very strong and muscular, the male branch set with numerous yellow hooks of the shape usual in the genus: the female branch with strong folds and lumps.

I think this specimen may be referred to *Pl. formosa*, or at least that there is not sufficient ground for creating a new species. It is certainly not *Pl. arrogans (cruenta)*, which has scarlet blotches but a pattern formed by minute dark lines, not spots. Allowing for the variations so common in this genus, the coloration corresponds fairly well with Alder and Hancock's description, and the grooved tentacles are a remarkable point in common. The chief discrepancy is that the branchial pocket is not distinctly lobed or stellate, as in the typical *Pl. formosa*; but I have noticed in many species of *Platydor* that though on an average this character may be very well marked, it may be indistinct in some individuals.

21. *PLATYDORIS ELLIOTI* (?) (A. & H.).

[Alder & Hancock, "Notes on a Coll. of Nud. Moll. made in India," Tr. Z. S. iii, 1864, p. 116.]

One specimen from Wasin, dredged in 10 fathoms.

The notes on the living animal describe the dorsal surface as being on the whole of a reddish brown, very beautifully mottled with various shades of sandy colour, the visceral mass being darker than the rest. The under surface was white: just outside the edge of the foot was a row of dark brown spots, and nearer the mantle-edge a bright orange border formed of spots set near together.

The alcoholic specimen measures 6.4 centimetres in length, 4.4 in breadth, and 2.4 in height. Like *Pl. scabra*, it is hard and rough. The colour is a mottled pattern of white, a sandy tint, and reddish brown. Beneath, the sides of the foot and the adjacent parts of the broad mantle, which is 2.2 centimetres wide, are thickly spotted with chocolate marks arranged so as to give the impression of a continuous band. Seventeen chocolate spots are irregularly arranged round the foot on a yellowish ground; then comes a fainter band also composed of chocolate spots; then a yellowish border extending to the mantle-edge. The foot is long and narrow, grooved and notched in front but not deeply. The rhinophore-pockets are closed by six projections. The branchial opening is also six-lobed, the anterior and posterior lobes being larger than the others, as in *Pl. eurychlamys* and *scabra*. The branchiæ are six, tripinnate, not very large. The oral tentacles are much retracted, white and conical. The buccal mass is large and muscular, the labial cuticle very strong but unarmed. The radula about $40 \times 70.0.70$; the teeth yellowish, simply hamate, the outermost smaller but not much degraded. The stomach is large and free, strongly laminated in parts; it appeared to contain sand, as well as alimentary matter. The penis is armed with two rows of hook-bearing scales of the usual type, but set very close together, each fitting into the next; the vagina with lumps but no scales.

I feel somewhat doubtful whether this animal should be called *Pl. ellioti*. Neither my specimen nor those described by A. & H. present any very definitely distinguishing characters. But, on the other hand, there is no feature of importance which militates against the identification, and the colours (which A. & H. record as varying) are sufficiently alike.

22. *PLATYDORIS PULCRA*, sp. n.

Two specimens from the neighbourhood of Wasin, dredged in 10 fathoms.

The living animal was of a beautiful orange-red, covered closely with minute lighter spots. Round the mantle was a border of dull white containing purplish-black spots and small specks in one specimen, and in the other dull violet spots. The under surface is described in the notes on living specimens as of uniform lighter orange, but in the alcoholic specimens there is a rim of faint

mottlings round the foot. The rhinophores were dark brown with white lamellæ; the branchiæ sandy-coloured. The animals were very stiff and harsh to the touch.

The larger alcoholic specimen is 3·8 centimetres long, and broader behind than in front, the maximum breadth being 2·2. The whole dorsal surface is covered with extremely minute granulations, which can only be seen under a strong lens. The rhinophore-pockets are very slightly raised and crenulate. The branchial pocket is stellate, with six not very distinct lobes; the branchiæ are six, tripinnate, small and deeply retracted. The anterior end of the foot grooved and notched as usual; the oral tentacles distinct, white and conical. The labial cuticle is strengthened by some minute rods, but they are not combined into a plate or rim. The radula consists of 36 rows, containing about 50 teeth on each side of the rhachis. The innermost and outermost teeth are smaller, the two or three outermost degraded but not denticulate. The male branch of the reproductive organs is armed with colourless scales, bearing erect spines, not hooks. The female branch has strong folds.

23. *PLATYDORIS INCERTA*, sp. n.

Seven specimens, found on brown sponges at low tide, Prison Island, Zanzibar.

The largest of the living animals was about an inch and a half long. They were all very flat in shape, sluggish, strongly adherent, and, though smooth, of the stiff coarse texture characteristic of the genus. The coloration rendered the animal invisible on the sponge, but was somewhat variable. As a rule it was yellowish brown, but one specimen was tinged with red and another with green. On the dorsal surface were collections of minute sandy dots, which in some specimens formed a line down the middle of the back. The underside was lighter in colour and without markings. The rhinophores were tipped with white, the gills brown or sandy.

The alcoholic specimens are all of a uniform dirty yellow. The measurements of the largest are: length 1·6 centimetres, breadth 0·9, height 0·4; the foot is 1·5 long and 0·7 broad. The rhinophore-pockets are crenulate, in some specimens slightly raised, in others closed and almost flat. The rhinophores have an unusually long stalk bearing a thick bunch of perfoliations, out of which rises a narrow bare tip slightly bent backwards. The gill-pocket is rather indistinctly stellate, with about six lobes, and contains six somewhat small bipinnate branchiæ. The foot is grooved in front and the upper lamina notched. The tentacles are narrow and digitate. There is no trace of labial armature. The radula formula is about $35.0.35 \times 60$. The teeth are white and simply hamate, of a rather thick and clumsy shape; the innermost are smaller but formed like the rest, the two or three outermost are degraded. The reproductive organs appear to be immature, but both the penis and vagina are armed with transparent, colourless, brick-like scales, apparently arranged in four

rows, each containing about ten scales. The central nervous system is as usual, with very large and distinct eyes.

The idea that the specimens are immature is supported by the size, which is small for the genus, and perhaps by the fact that a good many were found together. They are possibly the young of some already described form, and offer certain analogies with *Pl. vicina*, in which, however, only the male reproductive organs appear to be armed with scales (Bergh, *Semper's Reisen*, Suppl.-Heft i. 1880, p. 63).

24. *PLATYDORIS PAPILLATA*, sp. n.

Nine specimens from Chuaka.

The living animals were of varying but somewhat sombre coloration, ranging from dark peaty brown to yellowish brown, in all cases blotched with grey or black markings, greatly varying in extent and pattern. The under side of the ample mantle had a whitish border, then a yellowish area covered with minute brown dots, and, lastly, chocolate-brown blotches near the foot, sometimes few and separate, sometimes united in a band. The foot was greyish. The gill-pocket closed as in *Asteronotus*. The dorsal surface was covered with numerous small simple papillæ, and also bore some much larger-branched papillæ, which may have been as much as half a centimetre long. In the living animal they looked exactly like bits of sand. Their number varied greatly in different specimens: in some they were numerous, in others there were only a few near the mantle-edge. The largest living specimen was 11 cm. long and 7 broad.

The measurements in alcohol are: length 8.1 cm., breadth 5.1, height 2.8. The mantle-brim very thick and 1.6 wide. The texture of all the specimens, particularly on the mantle-brim, is very distinctly leathery, but not hard or rough. One specimen, with an almost smooth back, presents the appearance of *Asteronotus*, but is clearly distinguished by the presence of a few branched papillæ. Also, in all specimens the back is granulate, and not smooth as in *Asteronotus*. The rhinophore-openings are slightly raised and indistinctly crenulate. The branchial pocket can be closed by six lobes which meet over it; they are not all of the same size, and vary in different specimens. The branchiæ are six, tripinnate, and large. The foot is fairly broad and rather amply developed in front, where it has the usual notch and groove. It is, perhaps, as a consequence of this development that the oral tentacles, being pressed between the foot and head, appear flattened in most of the alcoholic specimens, and in some expanded into lobes as in *Hexabranthus*. There is no trace of labial armature. The radula is broad, and consists of from 30 to 40 rows, containing from 60 to 70 teeth on each side of the rhachis. The teeth are long and simply hamate, the two or three innermost are somewhat degraded; the two innermost are not parallel to the rest of the row, but are set almost at right angles to it and project into the large bare rhachis (a somewhat similar though less-marked arrangement may be seen in Bergh's figure

of the radula of *Asteronotus bertrana* S. R. plate lxviii. fig. 9). The male reproductive organs are armed with two rows of hook-bearing disks, each disk set at some distance from the next one. There appears to be an accessory gland on the female branch like the glandula amatoria of *Asteronotus*, but no hasta was discoverable. The central nervous system is much concentrated; above it anteriorly and posteriorly lie the two very distinct divisions of the blood-gland.

This species seems in many ways intermediate between *Platydoris* and *Asteronotus*. But as it has the characteristic genital armature of the former, and as one of the principal characters of the latter is that the back is quite smooth and neither granulate nor papillous, I have thought it better to refer my specimens to *Platydoris*.

The chief specific character is no doubt the branched dorsal papillæ. I think it probable that this animal is identical with the *Doris sordida* of Quoy & Gaimard from Mauritius, but as neither their description* nor their plate shows the branched papillæ, identification is impossible.

25. SCLERODORIS OSSEOSA (Kelaart).

[See Kelaart, "On new Species of Ceylonese Mollusca," in *Annals & Mag. of Nat. Hist.* vol. iii. 3rd ser. p. 298, 1859; and Alder & Hancock, "Notes on a Collection of Nudibranchiate Mollusca made in India," *Tr. Z. S.* iii. 1864, p. 121.]

Three specimens from the neighbourhood of Wasin. The notes on the living animals are unfortunately not forthcoming.

The alcoholic specimens vary in colour from pale yellow to greyish brown. They are hard and rough to the touch like *Platydoris*. The largest is 3·8 centimetres long, 2·2 broad, and 1·2 high. In all the specimens there is an indistinct dorsal ridge, and the back is irregularly reticulate and honeycombed; but while these markings extend over the entire upper surface in two specimens, they are confined to patches in the third. In all three there is one pit, larger and more conspicuous than the others, and surrounded by a protuberance in front of the gills. The mantle-brim is wide, and extends about 5 mm. beyond the head and tail. The rhinophore-openings are somewhat raised and closed by valve-like crenulations. The rhinophores are conical and not much bent back; the perfoliations cease before the tip. The branchial pocket lies at the end of the dorsal ridge and has raised edges; it is directed somewhat backwards and is crenulate. The branchiæ are six or seven, with the stem very large compared with the scanty perfoliations, which are bi- and sometimes tripinnate. The long and narrow foot is grooved and notched anteriorly. The tentacles are small, white, and conical. There is a strong bluish labial cuticle without any armature. The radula consists of about 40 rows, containing about 45 simply hamate teeth on

* Unless this feature is meant to be included under the observation "Cette espèce a un peu la forme d'une Onchidie."

either side of the rhachis; the innermost are smaller, the two or three outermost degraded and sometimes bifid. The vestibulum genitale, like the rest of the body, is full of rod-shaped spicules, but no armature could be discovered in the ducts.

I think this is undoubtedly the animal described by Kelaart (*l. c.* p. 298) and said to resemble a piece of bone or worm-eaten white stone. It is also not unlike Alder and Hancock's plate (*l. c.* xxviii, figs. 9 & 10). But their description does not entirely correspond with my specimens, particularly in speaking of the branchial pocket as "a cup, the margin of which is scalloped and produced into a large lobe in front." Kelaart, on the other hand, says there are four or five branchial plumes which emerge horizontally from under the posterior termination of the dorsal ridge, which is correct. The branchiae seem to be somewhat variable in number, and, as is often the case with Dorids, admit of being counted in more than one way.

26. *SCLERODORIS TUBERCOLATA*, sp. n.

One specimen from Prison Island, Zanzibar Harbour.

The following notes were made on the living animal:—"Dark brown with sandy spots, exactly like a sponge splashed with sand. Underside clear bright brownish red. Branchial pocket crenulate. The middle part of back covered with conical warts, which form an irregular keel; smaller warts on mantle-edge. Rhinophores red; branchiae eight, voluminous; axes red, tips white. Animal alters shape, sometimes rather high, sometimes quite flat like *Platydorid*. Consistency quite hard and rather rough. Two depressions with deep black markings as in some species of *Trippa*." The alcoholic specimen bears a strong general resemblance to *Trippa areolata*, but is stiff and spiculose like *Platydorid*, and has nothing of the flabby gelatinous feeling which characterises *T. areolata*. The back is covered with irregular tubercles, simple and compound, of all shapes and sizes, all granulate and sometimes connected by ridges so as to form a reticulation. There is an indistinct median ridge and two large pits with black bottoms, one in front of the branchial pocket and one about halfway up on the right-hand side. The general colour is greenish grey. The length is 6.5 centimetres, the breadth 4.2, and the height 2.2. The oral tentacles are distinct, digitate, and white. The foot is grooved and notched in front, the upper lamina being attached to the head below the mouth. The labial cuticle is strong and puckered, but no armature was discovered nor any ptyaline glands as in *Trippa areolata*. The radula consists of 40 rows, containing about 50 teeth on each side of the rhachis. These teeth are white and simply hamate; the innermost are smaller than the rest, the two or three outermost degraded and often bifid. The stomach is free and laminated internally. No genital armature was discernible.

The rhinophore-pockets are raised and provided with nine valve-like tubercles, of which two are much larger than the others. The rhinophores are short and thick, with about 50 perfoliations. The branchial pocket is entirely closed by ten valve-like tubercles,

some of which are grooved outside and thus appear double. The branchiæ are eight in number, tripinnate, and very much retracted. The rhachis is very stout and strong.

27. *SCLERODORIS MINOR*, sp. n.

One specimen from Chuaka.

The living animal is described as superficially resembling *Platydorís papillata*, differing only in that the dorsal surface is covered with ridges which form a raised reticulate pattern. The colour was a uniform greyish brown, with a few patches resembling adherent sand. The underside of the mantle was warm grey with minute brown spots, the foot dirty orange. The gill-pocket did not close completely when the branchiæ were retracted.

The alcoholic specimen is 2·7 centimetres long, 1·6 broad, and 1·1 high. The texture is rough and leathery, with the peculiar feeling common in *Platydorís*. All the dorsal surface, including the reticulations, is covered with minute tubercles. There is a rather indistinct median keel, from each side of which extends a somewhat irregular reticulate pattern. The rhinophore-openings are slightly raised and very slightly crenulate. The branchial pocket is also slightly raised, of irregular shape, but not crenulate, ridged vertically, and nearly but not quite closed. The branchiæ are eight, the two posterior shorter than the rest; the others are tall, thin, and sparse, so that in the alcoholic specimen they appear simply pinnate, though they are really bi- and sometimes tripinnate. The foot is rather broad; the front notched and the upper lamina apparently attached to the head, at the side of which are the conical oral tentacles. The snout is protruded. There are scattered minute rods in the labial cuticle, but they are not combined into plates. The radula consists of 33 rows of yellow, regular hamate teeth, which do not diminish much in size, either at the rhachis or at the end of the rows: there are about 45 on the complete rows on each side of the rhachis. No genital armature was discernible.

This specimen bears a strong general resemblance to *Sclerodorís tuberculata*, and may perhaps be a young individual of the same species. The radula is, however, not quite the same, there are no pits on the back, and the reticulate pattern is more distinct than in the larger animal. It is possible that as the animal becomes older the tubercles and pits may develop at the expense of the pattern.

28. *SCLERODORIS RUBRA*, sp. n.

One specimen from the reef off the East Coast of Zanzibar.

The living animal bears a most remarkable resemblance to a vermilion sponge which is common at Zanzibar. It was not, however, found on the sponge, but alone among *Zostera* near the shore, and not in any way concealed. It was picked up under the impression that it was a species of sponge. The colour was red, with some very natural-looking sandy patches. The texture was

firm and fleshy, with something of the rough feeling characteristic of *Platydoris*.

The alcoholic specimen is dirty white in colour with greyish blotches. The measurements are: length 5.5 centimetres, breadth 2.7, height 2.6. It will therefore be seen that the shape is very distinctly arched. In the middle of the minutely granulated back is an indistinct keel from which extends on either side a low fleshy reticulation. Independent of this reticulation, and sometimes concealing it, are a number of excrescences which, even in the alcoholic specimen, present the most extraordinary resemblance to the miscellaneous growths and accretions found on old shells and sponges. Some are as much as 4 millimetres high. I endeavoured to pull them off, being sure they could not be part of the mantle. They are so, however, and afford an even more remarkable case of mimicry than *Trippla areolata*. The edges of the rhinophore- and gill-pockets are crenulate, but not raised. The eight tripinnate branchiæ are deeply retracted into the bottom of the pocket. The anal papilla is large and has a cleft down the posterior side which appears natural. In the alcoholic specimen the foot is narrow with the edges turned inwards, but it was probably fairly broad in life: it bears a shallow groove in front, the upper lip of which is notched. The tentacles are very small and digitate. The blood-gland is large, reddish, and double: the central nervous system in a reddish capsule and much concentrated. There is no labial armature. The radula, which is large and wide, consists of 42 rows, containing about 55 large blunt hamate teeth on each side of the rhachis: the innermost are smaller than the others, and one or two of the outermost are also smaller and distinctly bifid. The reproductive system is unarmed.

29. *SCLERODORIS CORIACEA*, sp. n. (Plate XXXIV. figs. 3 & 4.)

One specimen from a cave near Chuaka on the East Coast of Zanzibar.

The living animal was yellowish brown in colour above and light orange underneath. The preserved specimen is 2.4 centimetres long, 1.7 broad, and .8 high in the middle of the back, the sides of the mantle being very low. The foot is large, being 1.9 centimetres long and 1.1 broad: the sides are developed into wide and very thin expansions. The anterior margin is deeply grooved, but the upper lip is not split though it is indented. The rhinophore-openings have somewhat raised and indistinctly crenulate edges. The branchial pocket is wide, conspicuous, and somewhat two-lipped in shape. The edge is turned outwards and is not at all crenulate. The branchiæ are six and tripinnate. The general texture of the animal is leathery, and the whole dorsal surface is covered with a distinctly raised but somewhat irregular reticulate pattern. Both this pattern and the ground surface are granulate. The buccal tentacles are long, thin, and pointed. There is no labial armature. The radula consists of 40 rows, with about 40 teeth on each side of the naked rhachis.

The teeth are simply hamate; the innermost are smaller; the outermost smaller and imperfect in shape, bifid or irregularly serrulate. The stomach is large, muscular, and free from the liver. No armature was visible in the reproductive apparatus, and the genital orifices were unusually small and inconspicuous.

On the right side of the liver was found a parasite (Pl. XXXIV. fig. 4), extending from the fore end halfway down, the head being bent downwards round the fore end of the liver. The impression of the parasite on the liver was very distinct.

This form has not the hard feeling characteristic of *Sclerodoris*, but as the back is leathery, reticulate, and granulate, I hardly think it advisable to create a new genus for its reception.

30. *ASTERONOTUS HEMPRICHII* Ehr. (Plate XXXIV. figs. 5 & 6.)

[Ehrenberg, *Symbolæ Physicæ, Animalia Evertebrata*, 1831.]

This large animal is common under rocks at Zanzibar and in all parts of British East Africa, between tides.

It has a characteristic feeling like leather or india-rubber, and not hard or rough like *Platydoris*. The ground-colour varies from black to olive or chocolate-brown. The skin is quite smooth, but bears a number of irregular lumps, resembling blisters in appearance. Towards the edges of the mantle they are smaller and somewhat confluent. Down the centre of the back runs a more or less elevated ridge, varying much in different specimens. All these protuberances are of a much lighter tint than the rest of the body. In some specimens there are small white lines round the lumps. The large branchiæ are white or pinkish. The under-side of the mantle is light yellow, with a row of chocolate blotches forming a line round the margin of the mantle and another round the foot. The coloration shown in the figure (Plate XXXIV. fig. 5), though an accurate representation of some specimens, is not the commonest. The greater number of individuals are more distinctly green. The animals are sluggish and show little inclination to move. The branchiæ are comparatively insensitive. Though completely retractile, they are not hidden when the teeth close over the pocket, but can be clearly seen at the bottom of the cavity (Pl. XXIV. fig. 6).

The largest alcoholic specimen measures 8·3 cm. in length by 6, and is 2·4 cm. high. The foot is 6 in length by 1·5; the anterior margin is deeply notched and grooved, the upper flap being very ample. The tentacles are large and in two specimens show a rudimentary foliation resembling that of *Hexabranchus*. This may be due to artificial compression, but I am not sure. The lips are also ample and protruding, so as to look like a second pair of tentacles. The rhinophore-pockets are somewhat raised and smooth, sometimes distinctly bilabiate. The branchiæ are six, ample, and quadripinnate. The margin of the pocket is produced into six lobes, which partially close over it. The radula consists of about 32 rows, each containing about 45 large yellow teeth on either side of the wide, naked rhachis. The teeth are simply hamate: the outermost two or three are smaller, and the inner-

most are set almost at right angles to the rhachis. The stomach is large and free, but thin and not laminated nor muscular. The blood-gland is large, and the nervous system is very concentrated. The generative system appears to be as described by Bergh, but the glandula and hasta amatoria are difficult to see and were satisfactorily detected only in one specimen.

These specimens are, I think, clearly Ehrenberg's *Asteronotus hemprichi*, from Massaua. He describes it as "sex-pollicaris, oblongus, glaber, vesiculosus, supra fuscus, lineis circulisque niveis sparsis, vesicæ dorsuales cingentibus, subtus lateritus, pede flavido, branchiarum apertura lobulis sex stellatim positæ præcludenda. . . . Branchiarum e dilute laterito seu carneo albicantium fasciculus amplus."

Prof. Bergh seems inclined to think (S. R. xvii. p. 917) that the real species of this genus are not more than three, *hemprichi*, *mabilla*, and *cæspitosus*. The differences between these three do not seem to me to be clearly defined, and my numerous specimens, which I unhesitatingly refer to one species, present connecting links, especially in colour, which make me think that the three species are merely varieties of one.

EXPLANATION OF THE PLATES.

N.B.—Except in the cases noted, the figures are drawn from the living animal.

PLATE XXXII.

Fig. 1. *Thordisa villosa* (p. 367), ventral view.

2. Dorsal view of the same.

3. *Thordisa crosslandi* (p. 368), ventral view. The margin of the mantle is turned here and there, showing the mobile papillæ which cover the dorsal surface.

4. *Trippa monsoni* (p. 371), dorsal view, much enlarged.

5. *Halgerda willeyi* (p. 372), from a drawing by Dr. Arthur Willey.

PLATE XXXIII.

Fig. 1. *Thordisa villosa* (p. 367), head and anterior end. The figure shows an extreme elevation of the body, which normally is flat.

2. Dorsal papilla of the same species, with flexible pigmented end and spicule-stiffened base. Also a portion of the mantle-edge magnified.

3. Branchiæ of the same.

4. *Thordisa crosslandi* (p. 368). Teeth from the radula: *a*, upstanding; *b*, laid flat.

5. Gills and anus of the same. A ridge (*a*) connects the higher part of the rhachis with the anal papilla (*b*).

6. Dissection of the retracted penis of the same, showing the shape and structure of the enclosed *glans*.

7. The *glans penis* of the same is slit open, showing it to be hollow and to contain a prolongation of the vas deferens which passes to its tip.

8. The central nervous system of the same in its sheathing of connective tissue.

PLATE XXXIV.

Fig. 1. *Halgerda wasinensis** (p. 373), dorsal view.

2. Diagram of the arrangement of its gill on the rhachis.

3. *Sclerodoris coriacea* (p. 383). Pencil drawing from the preserved specimen.

4. Degenerate Copepod parasite found in the liver of *Sclerodoris* (p. 384).

5. *Asteronotus hemprichi* (p. 384).

6. Enlarged view of the gill-opening when the branchiæ are as completely retracted as is possible.

7. *Kentrodoris rubescens* (p. 374), about half natural size.

* This name is wrongly spelt "*wassinensis*" on Plate.



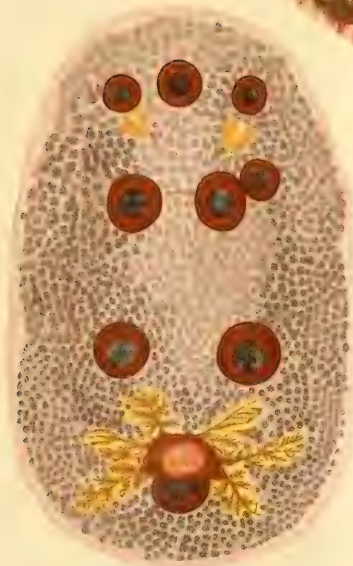
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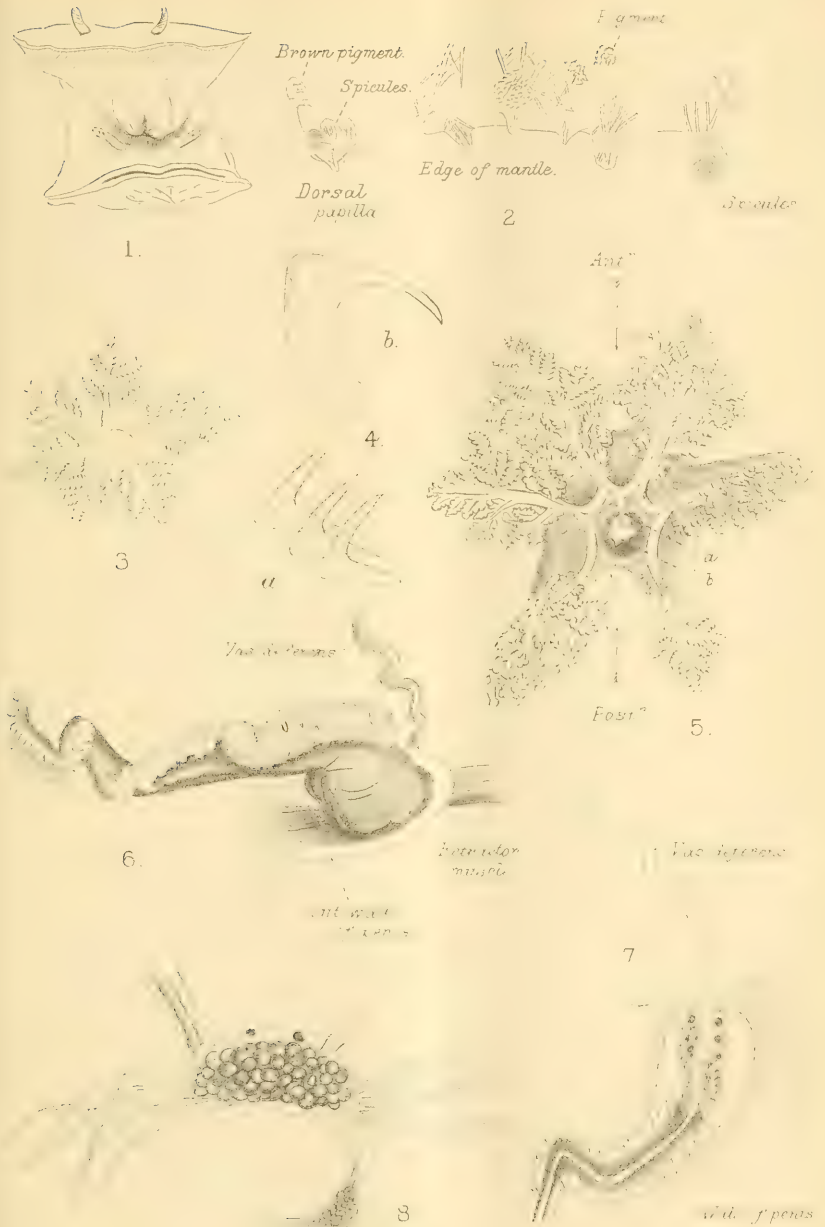


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C. Crossland del.
A. Willey del. fig. 5.

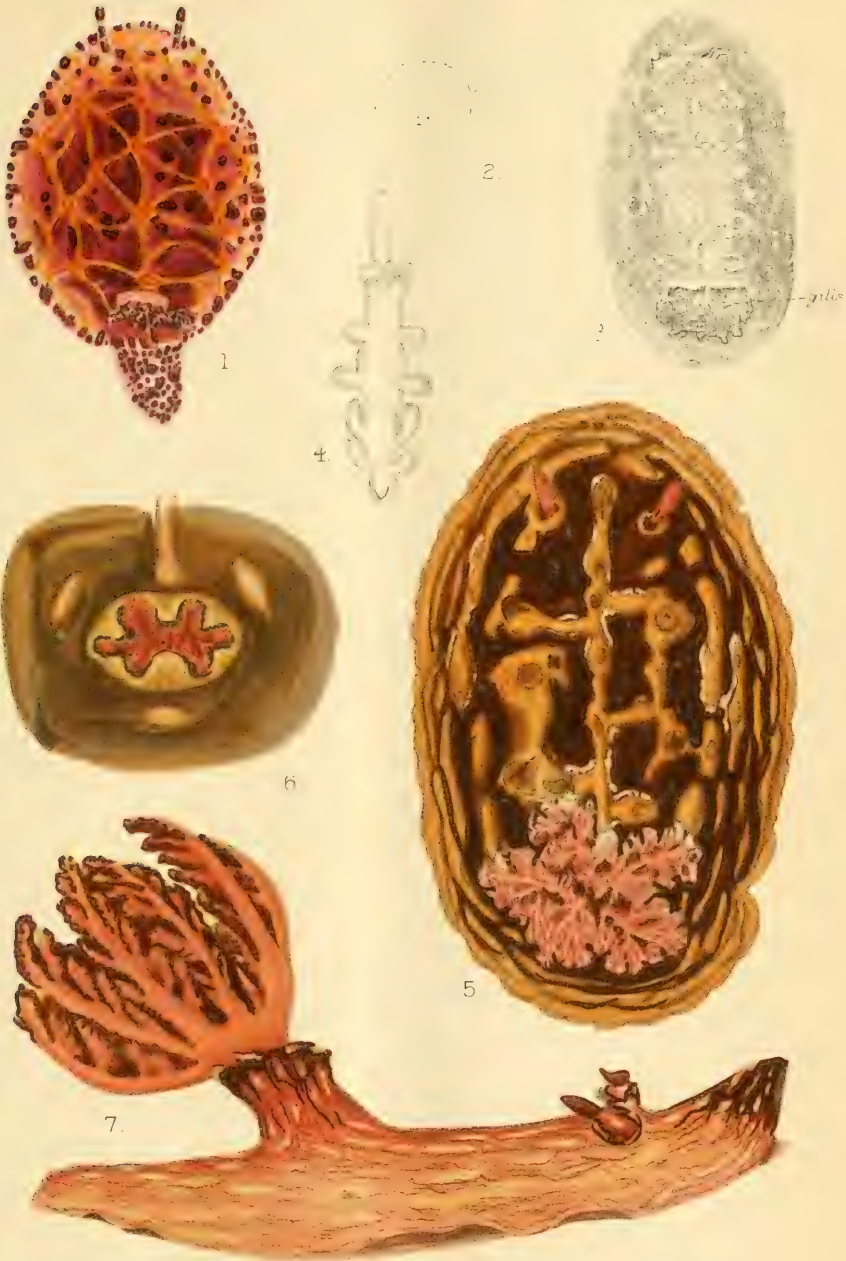
Huth. Lith. London.

1, 2. THORDISA VILLOSA. 3. T. CROSSLANDI.
4. TRIPPA MONSONI. 5. HALGERDA WILLEYI.



G. Crossland del.

Huth, Lith. London.



C. Crossland del.

Huth, Lith. London

1, 2. HALGERDA WASSINENSIS. 3. SCLERODORIS CORIACEA.
4. PARASITIC COPAPOD. 5, 6. ASTERONOTUS HEMPRICHI.
7. KENTRODORIS RUBESCENS.

15/13

With the complements
of the author.

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ON SOME NUDIBRANCHS FROM EAST AFRICA
AND ZANZIBAR. Part IV. BY SIR C. ELIOT,
K.C.M.G., late H.M. Commissioner for the East African
Protectorate, F.Z.S.—Dorididæ Cryptobranchiatæ, II.

[From the PROCEEDINGS OF THE ZOOLOGICAL SOCIETY OF LONDON,
1904, vol. i.]

[Published August 2, 1904.]

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On some Nudibranchs from East Africa and Zanzibar.
Part IV.* By Sir C. ELIOT, K.C.M.G., late H.M. Commissioner for the East African Protectorate, F.Z.S.—
Dorididæ Cryptobranchiatæ, II.

(Plates XXIII. & XXIV.†)

[The complete account of the new species described in this communication appears here; but as the names and preliminary diagnoses were published in the 'Abstract,' such species are distinguished here by being underlined.—EDITOR.]

In my last paper‡ I discussed the Cryptobranchiate Dorids represented by such genera as *Archidoris*, *Discodoris*, *Platydoris*, &c. These are oval flattish forms, mostly of sombre coloration, with a dorsal surface rarely smooth but generally granulated, or bearing papillæ, warts, or tubercles. The branchiæ are usually tripinnate. A labial armature is more often absent than present, there is no central tooth, and the radula consists of uniform, simply hamate teeth, rarely differentiated or denticulate. In the present paper I propose to consider some forms belonging to another group typified by *Chromodoris* and its allies. These Dorids are often (but not always) elongated and limaciform in shape, brightly coloured, and smooth. The branchiæ are usually simply pinnate. A labial armature is nearly always present (absent only in *Thorunna* and *Aphelodoris*). In the radula a central tooth is rare, but sometimes occurs (in *Cadlina*, *Tyrinna*, and *Chr. scabriuscula*), and rhachidian thickenings are frequent. The teeth are generally denticulate, and the tooth next to the rhachis is nearly always different in shape from the others. The stomach is usually enclosed in the liver, and there is rarely any armature in the reproductive organs. All these characters are well seen in *Chromodoris*; and I am inclined to think that the following genera are more or less closely allied to it:—*Casella*, *Ceratosoma*, *Thorunna*, *Aphelodoris*, *Orodoris*, *Sphærodoris*, *Cadlina*, *Tyrinna*, *Halla* §, *Rostanga*, and *Audura*. The common character possessed by all these forms is in the mouth-parts:

* For Part III. see P. Z. S. 1903, vol. ii. p. 354.

† For explanation of the Plates see p. 406.

‡ Since writing the third part of this paper (cf. P. Z. S. 1903, vol. ii. p. 354) I have read the last fasciculus by Prof. Bergh which has appeared in Semper's 'Reisen' (Bd. ix. Th. vi. Lief. i. Nudibranchiata, January 1904), and it appears to me that the genus *Peronodoris* is practically equivalent to that which I proposed to call *Sclerodoris*, and as it has priority should take the place of the latter name. The only difference in the generic characters is that for *Peronodoris* is given "penis stylo armatus." I did not see this style in any of the forms which I have described, but even if it is present in some species and absent in others, this variation would not in my opinion necessitate the creation of separate genera.

Archidoris violacea Bergh seems nearly allied to my *A. africana*, and *A. nanula* Bergh to my *A. minor*; but the identity of the forms, though not impossible, cannot be demonstrated from the descriptions.

§ [This name is preoccupied by a Polychæte worm, *Halla parthenopeia* A. Costu. Ann. Accad. d. Aspiranti Naturalisti Napoli, ii. p. 63 (1844).—C. CROSSLAND.]

nearly all have a labial armature, and all * have teeth more or less differentiated. I confess that I am afraid of attaching too much importance to the radula: a case like *Aldisa*, where a Dorid with otherwise ordinary characters has a unique dentition, certainly shows that the teeth may vary without any corresponding change in other characters; but in the genera here grouped together it will be found that the buccal characters are usually accompanied by some other feature which allies them to *Chromodoris*, such as simply pinnate branchiæ or a long narrow shape. It may be said that the teeth of Dorids are never really uniform, and in the genera described in my previous paper are often denticulate at the outer end of the row. This is true, but the outermost teeth are less well developed and more exposed than the others. They therefore have a natural tendency for purely mechanical reasons to become smaller and more irregular, and a particular form of this irregularity, due perhaps to some peculiarity of texture, is seen when they split up and become jagged or denticulate. But no such mechanical explanation will account for the innermost teeth being larger and more elaborately formed than the rest. Also this peculiarity is confined to certain genera, whereas the irregularity of the outermost teeth is general among the Cryptobranchiæ and as noticeable in *Chromodoris* as elsewhere.

Casella and *Ceratosoma* are clearly closely allied to *Chromodoris*, the former being perhaps not really a separate genus. *Thorunna* is practically *Chromodoris* without a labial armature. *Aphelodoris* has an elongate shape and narrow mantle-edge, but tripinnate branchiæ and no labial armature. It seems, however, to be allied to *Chromodoris* by the presence of an accessory denticle on the innermost teeth. The remaining genera are of more or less oval shape, with a fairly wide mantle-margin, and papillæ or tubercles on the back, peculiarities which are found in some species of *Chromodoris*. *Sphærodoris* has simply pinnate branchiæ and a radula which, though peculiar, is essentially of the *Chromodoris*-type. *Orodoris*, which Bergh associates with *Sphærodoris* and *Miamira*, has the median part of the radula much as in *Chromodoris*. *Halla*† and *Rostanga* are allied to *Chromodoris* by their simply-pinnate branchiæ as well as by their buccal parts: indeed, the former appears to me almost an aberrant *Chromodorid* akin to such forms as *Chr. sykesi* described below. In *Rostanga* the Mediterranean species *perspicillata* has denticulate inner teeth: in *coccinea* they are merely bifid. The buccal parts of *Tyrinna* and *Cadlina* strongly resemble those of *Chr. scabriuscula*, which has also a somewhat oval form and tuberculate back. I somewhat doubtfully refer *Audura* to the same group, in virtue of its radula. This position is somewhat supported by its smooth skin and scanty bipinnate branchiæ, but the structure of the foot suggests other affinities.

* Except the very anomalous *Miamira*, which Bergh regards as allied to *Sphærodoris* and *Orodoris*.

† See note § on p. 380.

The following is a list of the forms noticed below :—

Chromodoris A. & H.

1. *Chr. reticulata* Pse.
2. *Chr. sykesi*.
3. *Chr. cavee*.
4. *Chr. annulata*.
5. *Chr. splendens*.
6. *Chr. tryoni* (Gar.).
7. *Chr. vicina*.
8. *Chr. elizabethina* B., var. *africana*.
9. *Chr. runcinata* B.
10. *Chr. nigrostriata*.
11. *Chr. scurra* B.
12. *Chr. hilaris* B.
13. *Chr. lineata* Souleyet.
14. „ „ var. *nigrolineata*.
15. *Chr. ? magnifica* Q. & G.
16. *Chr. inconspicua*.
17. *Chr. flava*.

Casella H. & A. Adams.

18. *Cas. atromarginata* (Cuv.).

Ceratosoma Adams & Reeve.

19. *Cer. cornigerum* (Ad.).

Sphaerodoris B.

20. *Sph. laevis* B.

Orodoris B.

- | | |
|----------------------------|---|
| 21. <i>O. miamirana</i> B. | } (From Willey's New Britain Collection.) |
| <i>Miamira</i> B. | |
| 22. <i>Mia. nobilis</i> B. | |

Genus CHROMODORIS.

More than 100 forms are referred to this large genus, but are by no means all equally certain. About 40 have been described by Prof. Bergh, and may be regarded as well established. Most of the remainder are known only from the external characteristics often very superficially described, and many of the so-called species are probably merely varieties.

The animals are as a rule soft, smooth, and brightly coloured. The branchiæ are simply pinnate, the tentacles small and capable of retraction. There is a strong labial armature and a characteristic radula. The rhachis often bears thickenings: the first tooth on each side of it is denticulate on both the inner and outer sides, and thereby differs from the rest, which are denticulate on the outer side only. The outermost are irregular and denticulate on the apex only. There is no stomach outside the liver.

Within the limits of these characters there is such great variety that it may be doubted if the genus should not be split up.

The following notes on the principal divergencies presented have no pretension to be exhaustive, but may perhaps prove useful.

1. As a rule the shape is somewhat high, elongated, and limaci-form, with a narrow mantle-edge, but some species are low and distinctly oval, with the mantle-edge very wide and ample. Such are *Chr. reticulata*, *sykesi*, *cavae*, and *annulata* here described; and it would appear from the published plates and descriptions that *Chr. albescens*, *iheringi*, *punctilucens*, *histrion*, *propinquata*, *splendens*, *albo-pustulosa* have a similar shape. Some species (e. g. *Chr. vicina*) are capable of assuming two forms—one high and narrow, the other flat and oval; so the distinction in shape may perhaps not be absolute*.

2. The skin is usually soft and smooth, but the dorsal surface bears tubercles in *Chr. orsinii*, *sannio*, *pustulans*, *verrucosa*, *lapinigenis*, and the somewhat doubtful *roseopicta* of Verrill. The very abnormal *Chr. scabriuscula* is spiculate with hard lumps.

3. *Chr. runcinata*, *pantharella*, *sannio*, *picturata*, *camœna*, *elegans*, *glauca*, *californensis*, *gonatophora*, *syccilla*, have small knobs, apparently of a glandular character, on the underside of the mantle-margin.

4. The colour is hardly ever uniform. There is usually a coloured border (sometimes double) round the mantle-edge, and generally a pattern on the back formed of stripes or spots. Although this pattern may vary considerably within the species, the spotted and striped forms appear to be distinct. Sometimes, however (e. g. in *Chr. runcinata*), spots arranged in a line unite to form a stripe, and *Chr. semperi* and *nigrostriata* appear to be the same, except that the first is spotted and the second striped. It would be rash in the present state of our knowledge to make any general statement as to the correspondence between these two types of pattern and other characters, but in a considerable number of species stripes are combined with an elongate form and bifid teeth, with or without accessory denticles under the bifurcation (e. g., *Chr. cœrulea*, *gracilis*, *messinensis*, *syccilla*, *carnea*, *hilaris*, *lineata*, *marenzelleri*, *thalassopora*, *lapinigenis*); while another combination, of an oval form, spotted pattern, and teeth bearing many denticles but not bifid, is presented by *Chr. reticulata*, *sykesi*, *cavae*, *annulata*, *punctilucens*, *splendens*, and *histrion*. Elongated spotted forms are not uncommon, but none of the oval forms with ample mantles as yet recorded are striped.

5. The branchiæ range from 5 to nearly 30 in number, and are variously arranged in a complete circle, or a circle more or less open behind or a double spiral (see Plates XXIII. figs. 2 & 8; XXIV. fig. 2). Sometimes the plumes are uniform in size; sometimes those in front (more rarely those behind) are larger. Typically they are quite simple, but frequently some are bifid and sometimes several branches are developed (e. g. *Chr. tryoni* and *striatella*). But when this occurs the ramifications are thin and irregular, and

* [I observed this change of shape in some of the species here dealt with during life.—C. C.]

the plumes do not resemble the ample and elaborate rosettes of *Archidoris*, *Platydoris*, &c. The arrangement and the approximate (but not the exact) number of branchiæ will probably be found good specific characters in cases where a sufficient number of individuals has been examined; but I think that the number of plumes increases with age, at any rate in some species, and that hence the data furnished by a single specimen may be misleading. This is the case particularly in forms with a spiral arrangement, where it seems likely that the small plumes in the spire are developed later than the others. Thus in *Chr. sykesi* the number varies from 12 to 18 and in *Chr. annulata* from 9 to 16. In the latter species a spire is present in some cases and absent in others. The commonest number of branchiæ seems to be about 10 (varying from 8 to 12 in individuals). A distinctly smaller number (3 to 7) is found in *Chr. cardinalis*, *juvenca*, *elegantula*, *iheringi*, *krohnii*, *virginica*, *gloriosa*, *scurra*, *luxuriosa*, *albonotata*, *inconspicua*, *elegans*, *camana*, *rudolphi*, *pantharella*, and is indicated in the drawings of many other species. In *Chr. punctilucens*, *lineolata*, *paupera*, *tryoni*, *bennetti*, *splendens*, *crossei*, *dalli*, *reticulata*, *godeffroyana*, *mollita*, *vicina*, *sykesi*, and *annulata* the number of plumes is more than 12 and often exceeds 20.

I have observed that in making a superficial examination of the living animal one is very apt to under-estimate the number of branchiæ, inasmuch as the longer ones may project and the shorter ones be hidden. Hence the plates and descriptions of older authors cannot be considered as decisive on this point.

6. The labial armature consists sometimes of two plates and sometimes of a continuous ring. The elements are hardly ever straight, but are more or less bent or hooked. They are of very varying shape and thickness, and sometimes swollen just below the tip or terminal hook, so that they assume a mace-like appearance. The shape usually affords a good specific character, but in some species the elements are bifid in one part of the armature and entire in another.

7. The radula offers many differences. *Chr. scabriuscula* has a central tooth and *Chr. juvenca* a central plate which is called "false" by Bergh, though it seems well developed. Rhachidian thickenings, more or less distinct, are found in *Chr. cærulea*, *iheringi*, *mörchii*, *gonatophora*, *porcata*, *carnea*, *mariana*, *hilaris*, *sannio*, *lineolata*, *marenzelleri*, *cardinalis*, *reticulata*, *dalli*, *cæca*, *annulata*, *splendens*. The radula is as a rule of moderate size, but is very narrow in *Chr. elegantula*, *krohnii*, *gloriosa*, and rather narrow in *pustulans* ($75 \times 28.0.28$) and some other forms. In *scabriuscula* it is $108 \times 30.1.30$. It is unusually broad in *thalassopora* ($71 \times 162.0.162$), and above all in *sycilla* ($81 \times 290.0.290$).

The formulæ for the radula given in my descriptions are merely the shortest way of describing the teeth of a given specimen, and must not be understood as necessarily characteristic of the species. The proportion between length and breadth is generally roughly the same in different individuals, but the number of rows and of

teeth in them varies greatly and apparently increases with the size (that is probably the age) of the animals.

As regards shape, the teeth present several types :—

(1) They are simply bifid in *cærulea*, *semperi*, *nigrostriata*, *marenzelleri*, *crossei*, *thalassopora*, *camæna*, *lapinigenis*. In these species the innermost tooth bears a single accessory denticle on the inner side and hence appears trifid.

(2) They are bifid with accessory denticles below the bifurcation in *gracilis*, *messinensis*, *syella*, *hilaris*, *bennetti*, *californensis*, and *agassizi*. In *runcinata* the accessory denticles are very small and inconspicuous.

(3) In *scurra* the apex of the tooth is three or five times cleft, and a somewhat similar arrangement, by which the denticles are all on the upper part of the tooth, appears to occur in *pustulans*, *gloriosa*, and *rudolphi*.

(4) The commonest form of tooth is hamate, with several (6-10) denticles on the outer side. These are generally fine and minute, but in some forms (e.g., *porcata*, *rosans*, *mariana*, *elizabethina*, *paupera*, *tryoni*, and *godeffroyana*) are large and strong. In this class of radula the innermost teeth have generally several denticles on each side, but sometimes (e.g., *mörchii* and *gonatophora*) only one on the inside.

Of the species described below, the first four are closely related, and form a group to which I am almost disposed to accord generic rank. I have not done so out of deference to the high authority of Prof. Bergh, as one of the animals appears to be identical with the *Goniobranchus reticulatus* of Pease, examined by him and referred to *Chromodoris*. All four forms agree in being oval and flat in shape, with a very ample mantle-margin. The consistency is very soft, and the dorsal pattern composed of spots, not stripes. The innermost teeth of the radula bear a few denticles on both sides; the rest 6-10 denticles on the outer side only. The branchiæ are numerous, and the sides of the mouth are connected with the upper lamina of the grooved foot. This latter peculiarity was noted in the living as well as in the alcoholic specimens; but I am not sure that it is of much morphological significance, for in a very soft animal with ample flaccid integuments such folds may easily be formed at the corners of the mouth without constituting distinct structures.

Nos. 12-15, described as *hilaris*, *lineata*, *lineata* var., and ?*magnifica*, are very likely all varieties of one striped species, with bifid teeth bearing accessory denticles, and about 10 branchiæ, but a larger number of living animals must be examined before this identity can be established.

All my species which are not new have been previously found in the Indo-Pacific, which appears to be the head-quarters of the genus, though not enough is known of the Nudibranchs of the tropical Atlantic to make any comparison as to numbers of species. About half a dozen forms are reported from the West Indies and the Gulf of Mexico. The genus is mainly tropical, and in

Europe is not found north of the Mediterranean. In the Pacific it extends to Japan and Puget Sound.

1. *CHROMODORIS RETICULATA* Pease. (Plate XXIII. figs. 1-5.)

[See Bergh, "Neue Nacktschnecken, No. iv.," Jour. Mus. Godeffroy, Heft xiv. p. 9 ff.]

Four specimens, found at different times on both the East and West Coasts of Zanzibar at low tide.

The colour and size vary considerably. The following is the description of one living specimen:—"23 millimetres long, 12 wide. Foot narrow, with the sides crinkled. Mantle-edge fairly ample and undulated. The whole animal very soft and almost gelatinous. The dorsal surface whitish, with numerous red reticulations, which became closer at the edge and formed a red border. Outside this was a yellow border, passing over to the underside. The rhinophore and branchial openings were not raised. The rhinophores were crimson-lake, with fine white lines on the perfoliations. The branchiæ were of a transparent light pink, with two lines of crimson-lake down the main axis. The under surface of the animal was of a beautiful opaque white. The foot projected behind the mantle."

Another specimen (67 millimetres long and 30 broad) was described as much lighter than that just noticed, but having similar lines and reticulations; there was no crimson-lake and no red border; all the red and yellow markings were bright and light. It was infested with violet-coloured copepoda.

On the other hand, two other specimens were of a much darker colour. The general effect was reddish brown, due to a close reticulation of that shade on a dirty-white ground. The mantle-border was a dark reddish orange. The gills were of a very deep colour, and in one specimen almost black. The pinnae were so thick and swollen that until closely examined each plume appeared to be a simple column.

The alcoholic specimens are flat, smooth, and very soft. The branchial openings are fairly large, but in the living animal were capable of contracting and almost closing. The branchiæ are 22 to 24 in number, set in an incomplete circle with the ends turned inwards in a spiral (Pl. XXIII. figs. 2 & 3). The front plumes are long and slender, while those behind in the spiral are very small. Hence on a superficial examination only 10 or 12 are visible. The foot is rounded and grooved anteriorly, and the upper lamina is connected with the sides of the mouth (Pl. XXIII. fig. 1). Near the points of junction appear to be two indistinct retracted tentacles.

The labial armature is a dense mass of long rods, slightly curved and bifid at the end. On the rhachis of the radula* are transparent lozenge-shaped thickenings. The innermost teeth

* Only one preparation of the radula has been preserved from one of the darker specimens.

next to the rhachis bear 3-4 small denticles on each side, and those nearest to them are somewhat similar but denticulate only on the outer side; the others are long and hamate, with about 8 denticles on the outer side (Pl. XXIII. fig. 4, *a*, *b*, *c*). The outermost bear 3-4 denticles on the apex. A drawing of the alimentary canal is annexed (Pl. XXIII. fig. 5).

I think these animals can be referred to *Chr. reticulata* Pease, with which Collingwood's *Chr. alderi* seems to be identical. All my specimens are flat, with ample mantle-margins, and this agrees with Collingwood's description and plate. Bergh, on the contrary, says: "Die Körperform ist länglich nicht sehr niedergedrückt . . . der Mantelsaum ziemlich schmal." But these soft Chromodorids have great powers of changing their shape and proportions. The branchiæ are much more numerous than in the specimens previously described, but a multiplication of the small plumes in the spiral does not appear to constitute a specific difference.

2. CHROMODORIS SYKESI. (Plate XXIII. fig. 6.)

Chromodoris sykesi Eliot, Abstr. P. Z. S. 1904, No. 4, p. 15, March 8.

Numerous specimens from the East Coast of Zanzibar, obtained both on the shore and by dredging. A few of the animals were of a reddish brown with dirty yellow markings, but in the majority the coloration was most gorgeous (Pl. XXIII. fig. 6). The dorsal surface was bright orange, passing into light yellow towards the edge of the mantle, round which was a double border of reddish brown internally and bright violet externally. On the back were numerous rings of opaque white, but otherwise the whole body was translucent. The foot and underside of mantle were of a rich light yellow. The rhinophores and branchiæ were both of a deep brown-red with opaque white spots. The perfoliations of the rhinophores were indistinct, and the pinnae of the branchiæ small though made conspicuous by white lines drawn along them. The animal was rather flat and very soft. The mantle was very ample.

The largest alcoholic specimen is 40 mm. long, 27 broad, and 10 high. The free edge of the mantle measures 7 mm. over the head, 10 at the sides of the body, and 13 over the tail. In giving the measurements, the breadth of the body is estimated as the mantle falls in its normal position: the edge of the mantle is taken as extended, but not stretched unnaturally. The openings of the rhinophores and branchiæ are small and only slightly raised, but the interior of the branchial pocket is a capacious and very strong bag. The branchiæ are arranged as in *Chr. reticulata* and vary from 12 to 18, according to the size of the spiral. They are red and striped with white. The anal papilla is tall, red and spotted with white. The foot is rounded and grooved in front. Two rather strong folds connect the upper lamina with the corners of the mouth. The oral tentacles were not distinctly

developed in any specimen, but in some there were bulges which may represent these organs in a state of contraction. The labial armature is a strong, rough yellowish ring; it consists of fairly long rods, hooked at the end. The radula is deep red; the formula is about $55 \times 50.0.50$. The innermost teeth have a moderately broad central cusp, with two or three denticles on the side nearest the rhachis and five or six on the outer side. The next two or three teeth are much like them, but are denticulate only on the outer side. The other teeth are long and hamate, with from six to ten minute but distinct denticulations on the outer side only. The outermost teeth retain their form fairly well, though they are smaller than the others.

This beautiful species is dedicated to my friend Mr. E. R. Sykes as some slight acknowledgment for the invaluable assistance he has rendered me in seeing my papers on the Nudibranchiata through the press.

3. CHROMODORIS CAVÆ. (Plate XXIII. figs. 7 & 8.)

Chromodoris cavæ Eliot, Abstr. P. Z. S. 1904, No. 4, p. 15, March 8.

Several specimens from the East and West Coasts of Zanzibar.

The following are the notes on the living animal:—"Colour yellowish white, with indefinite large drab blotches laterally. Edges of mantle and foot bordered with light violet. On the back are black spots surrounded by a white line and also irregular dull orange spots. The foot is not very broad, white in colour, with a row of dull orange spots and black spots below them. The tip and anterior side of the rhinophores are purple; the lamellæ are reduced to fine striations. The margins of the rhinophorial and branchial pockets are not at all raised; the rhinophores and gills when retracted are not completely out of sight. The mantle is ample. The skin is quite smooth and even. In captivity the animals sometimes swim on the surface of the water, foot uppermost."

The measurements of the largest alcoholic specimen are:—Length 60 mm., breadth 34 mm., height 14 mm., free edge of mantle 10 mm. over the head, 9 mm. at sides of body. The branchiæ (Pl. XXIII. figs. 7 & 8) vary from 12 to 16. Ten are fairly large and form a circle open behind. On the inside of this circle are set on either hand from one to three smaller plumes. The foot is grooved in front and the upper lamina is attached to the side of the head. The mouth is a very distinct vertical slit, and at its lower corners, just about the point where the lamina of the foot terminates, are a pair of fairly well-developed tentacles. The labial armature is a not very compact mass of long bent rods, not bifid at the end. The rhachis of the radula bears transparent lozenge-like thickenings, which are, however, not very distinct. There are about 60 rows containing about 70 teeth on each side of the rhachis. The innermost are much as in *Chromodoris sykesi*, but the central cusp is broader and there are about 5 denticles on the

outer side. The second and third are much like the innermost, but are denticulate on the outer side only. The rest are simply hamate, of the ordinary shape, and bear about 10 minute denticles. The outermost are, as usual, irregular, and the denticulations are mainly on the apex.

4. CHROMODORIS ANNULATA. (Plate XXIV. figs. 1-3.)

Chromodoris annulata, Eliot, Abstr. P. Z. S. 1904, No. 4, p. 15, March 8.

Many specimens found among *Zostera* off the mouth of the Creek at Zanzibar and other places at low water during spring-tides.

The living animal (Pl. XXIV. fig. 3) was very soft, with an ample undulated mantle-margin. A large specimen when in an extended condition was 55 mm. long and 15 wide, but when contracted the same individual was 45 mm. long and 25 wide. The upper surface was of a somewhat translucent white, studded with yellow spots. Round the margin was a border of deep purple, and two rings of the same colour were so placed as just to include the rhinophores anteriorly and the branchiæ posteriorly within their respective areas. The underside was white, with yellow spots on the tail and the sides of the foot. The rhinophores were deep purple, and so long that they were rarely wholly retracted. The branchiæ were white, with a deep purple stripe down both the inner and outer edge, and were kept waving from side to side. The animals were found in conspicuous positions, and made no attempt to hide themselves among the *Zostera* weed.

By a somewhat unusual change, which deserves to be noticed as showing how preserving-fluids may alter colour, the alcoholic specimens have become of a reddish purple with white spots, the border and rings having disappeared* and apparently diffused their pigment over the whole surface. Fortunately the notes on the living animal were very full, and there appears to be no doubt that the specimens are the same despite their transformation. The body is very soft and the skin perfectly smooth. The mantle is ample, the free edge measuring 7 mm. over the head and 6 at the side in a specimen where the visceral mass is 10 mm. broad. The openings of the rhinophores and branchiæ are slightly raised in some, but not in all the specimens, and vary in size. They are no doubt capable of contraction and expansion in life. The branchiæ (Pl. XXIV. fig. 2) vary in number from 9 to 16 according as an inner row is present or not, but on an average the smaller number is more frequent in this species than in *Chr. reticulata*, *sykesi*, and *cavæ*. The foot is narrow and rounded, grooved in front but not notched. Two small folds pass upwards from the foot, uniting it with the sides of the head and with the mantle. The tentacles are small and placed at the lower angles of the mouth. The labial

* [Their dark purple-blue became almost at once a light red, which disappeared gradually.—C. C.]

armature is formed of two large strong triangular plates, almost united into a ring, dark brown, and formed of a mass of long hooks. The rhachis of the radula (Pl. XXIV. fig. 1) bears lozenge-shaped thickenings, on each side of which are about 45 teeth. The number of transverse rows is about 70. The innermost teeth have a large denticle on the inner side, and three small ones on the outer; the rest are simply hamate, with 8-10 minute denticles; the outermost irregular and denticulate on the apex in the younger rows, but in the older the denticulations seem to have been worn off.

5. CHROMODORIS SPLENDENS.

Chromodoris splendens Eliot, Abstr. P. Z. S. 1904, No. 4, p. 15, March 8.

[? = *Chr. splendida* Angas, Journal de Conch. i. 1864, p. 55.]

Two specimens from Chuaka, East Coast of Zanzibar. The notes on the living animal are as follows:—"General colour somewhat miscellaneous, being produced by thick collections of purple and white dots, in different proportions in different places. A vivid orange border round the whole body. Underside milk-white. Mantle ample. Gill-pocket fairly large, gills purplish."

The alcoholic specimens are of a uniform dirty yellow, and of about the same size. Length 40 mm., breadth 13, height 10. The free portion of the tail is 6 mm. long, but is entirely covered by the mantle, the free margin of which measures 7 mm. behind and 5 mm. at the sides and head. The rhinophores are large. The edge of the branchial opening is slightly raised. The total number of branchial plumes is 27, but of these three seem to be accessory ramifications and not independent branchiæ. The circuit is open behind, and the two ends are turned inwards in a spiral. The anterior plumes are large, and those in the spiral very small, so that the living animal shows ten or twelve branchiæ. The foot is rather wide, with thin margins, and is dilated and deeply grooved in front. The tentacles are distinct. The inconspicuous labial armature consists of two small yellowish plates, composed of fairly long bent rods, most but not all of which are bifid. The radula is also yellowish, with about $70 \times 60.0.60$ for formula. On the rhachis are indications of triangular thickenings, but the base of the triangle is not distinct. The innermost teeth bear three or four denticles on the inner and five on the outer side. The rest are hamate, rather erect, with six denticles under the hook decreasing in size downwards. The outermost show less difference from the rest than usual, and are long, erect, with about four denticles on or near the apex.

I think it very probable that this is the animal described as *Goniodoris splendida* in the 'Journal de Conchyliologie,' and I have indicated this probable identity in the name. The scheme of coloration is very similar, and the ample mantle, large rhinophores, and numerous branchiæ are also points of resemblance, but the purple in the present specimen is distributed in the form

of small dots, and not collected into large spots. But it is possible that the buccal parts of *Chr. splendida*, respecting which we have no information, may present specific differences, and identification is therefore at present not warranted.

6. CHROMODORIS TRYONI (Gar.) var. (= *Chr. aureo-purpurea* Collingwood).

[See Bergh, "Neue Nacktschnecken, No. iv.," Jour. Mus. Godeffroy, Heft xiv. p. 14 ff.]

Two specimens from Chuaka, the larger of which was about three inches long in life. The body was quite smooth and very soft. The mantle and edge of foot bordered with light violet; the back translucent, allowing a rough, broad, net-like grey pattern to be seen beneath the surface; the whole surface covered with opaque spots of bright orange-yellow. Foot broad and deep, with white sides bearing orange-yellow spots. The rhinophores with purple lamellæ and a longitudinal white stripe behind. The simply pinnate branchiæ white, with a deep purple stripe down each edge*. The animal was lively in its movements, and the branchiæ continually waved with a quick vigorous motion from side to side.

The alcoholic specimen is 35 mm. long, 13 broad, and 15 high, stoutly built, with a narrow mantle-edge of only 3 mm., and the tail projecting 8 mm. behind. The edges of the rhinophore and branchial pockets are slightly raised. The branchiæ seem to be 27 in number, the median anterior plume being the largest. The circuit is interrupted behind, and the ends of the row of plumes turned inwards in a spiral. Several of the plumes are bifid at the tip. The anterior margin of the foot is slightly grooved but not notched. The labial tentacles are very small and set somewhat above the mouth. The lips are large. The labial armature consists of two strong, rough plates composed of a closely-compacted mass of small thick hooks. The long white radula has 96 rows of colourless teeth, containing about 50 teeth on each side of the rhachis, which exhibits folds and puckers. The teeth have the characters usual in the genus; the innermost bear four denticles on both sides, the others five large and distinct denticles below the terminal hook on the outermost side only, the highest being the largest. In the outermost the denticles move upwards, till they are all on the apex of the teeth. The form of the teeth and labial armature is accurately represented in Bergh's plates.

I think this form may be safely identified with *Chr. tryoni*. It differs from Bergh's description only in the absence of ocelli with black centres. It appears to be also identical with Collingwood's *Chr. aureo-purpurea*, though the latter is said to have only 10 branchiæ. The two varieties may be described as *Chr. tryoni* var. *ocellata* and var. *aureo-purpurea*.

* [I quote from the notes on the living animal, but must admit that this expression is obscure. (Outer and inner sides, parallel with blood-vessels shown in fig. 3, Pl. XXIII.—C. C.)]

7. CHROMODORIS VICINA.

Chromodoris vicina Eliot, Abstr. P. Z. S. 1904, No. 4, p. 15, March 8.

Twelve specimens from Chuaka.

The following notes were made on the living animal:—

“Mantle and foot bordered with light violet, the latter border a row of dots. Middle of back drab-brown with bright violet spots, the larger ones with a white centre. Near the edge of the mantle a number of yellow spots with white borders, which are often confluent. The foot deep and narrow, white with some yellow spots near the lower edge. The rhinophores dark brown with white tips. Each of the branchiæ bore two black bands.”

The alcoholic specimens are of a dull reddish brown and present two very different forms: one long and narrow, measuring 37 mm. in length and 9 mm. in breadth, and the other oval, being 27 mm. long and 20 broad. Both are about 20 mm. high. The margin of the mantle is about 6 mm. wide, and forms a sort of hood over the head. The branchial opening is very small. Both it and the rhinophore openings are slightly raised. The branchiæ are 16 in number, the circuit is open behind, and the row of plumes turns inwards in a small spiral. The foot is long and narrow. In the long form of the animal it projects about 5 mm. beyond the mantle; in the broad form it is covered by it. The anterior margin is rounded and grooved, but not notched. On each side of the mouth is a small conical tentacle.

The labial armature consists of two yellowish plates composed of rather long rods, bifid at the tip and generally bent into the form of hooks, but sometimes straight. These are much like the same organs in *Chr. striatella* (vide Bergh, ‘Challenger’ Reports). The formula of the radula is about $50 \times 45.0.45$. The rhachis is bare but exhibits in places a slight wavy fold. The innermost teeth bear three denticles on each side of the central cusp. The next two or three are of much the same shape, but denticulate only on the outer side. The majority are tall and straight, bearing five large and distinct denticles under the terminal hook, and sometimes two or three small irregular denticles in addition. The five or six outermost are irregular in shape, and bear from three to six irregular denticulations mostly on the apex.

This species is closely allied to *Chr. tryoni*, and will not improbably prove to be a mere variety of it. All the present specimens, however, have a somewhat different coloration, fewer branchiæ, and more numerous denticles on the teeth.

8. *CHROMODORIS ELIZABETHINA* B., var. *AFRICANA*. (Plate XXIV. fig. 4.)

Two specimens from the East Coast of Zanzibar. The notes on the living animal describe the dorsal surface as black and white, black preponderating. The mantle had a double border, yellow

outside and white inside, as had also the foot. In the middle of the back were two longitudinal white lines uniting behind the branchiæ; on the tail, which projected well behind the mantle, was one white line. The gills and rhinophores were yellow, and the slightly raised pockets of both were fringed with the same colour. The creeping-surface of the foot was narrow. The sides of the body were black with a white stripe between the mantle and the foot.

The alcoholic specimens are high and stout, with the colours fairly well preserved. The largest is 26 mm. long, 13 broad, and 10 high. The mantle-margin is fairly ample, measuring about 3 mm. at the sides and head, 5 mm. over the tail. Of the branchial plumes there is only one which can be called simply pinnate in the strict sense, all the rest being more or less bipinnate. Some are merely bifid, and some bear four or five branches. It is rather difficult to say what is the number, as when a small plume springs up at the base of a large one it may be counted either as an accessory branch or as a separate branchia, but they may perhaps be described as 10, set in a semicircle. The foot is grooved and notched in front; the tentacles are close together above the mouth, conical and larger than usual in the genus. The labial armature is greyish and formed of a thick mass of bent rods, some bifid but most simple. The formula of the radula is in one specimen $94 \times 90.0.90$ and in the other $90 \times 75.0.75$. The innermost teeth bear three denticles on both sides; the remainder 3-4 minute denticulations on the outer side only, and some are quite smooth and simply hamate.

I think these specimens may be referred to Bergh's *Chr. elizabethina* (S. R. xi. pp. 466-473). The difference in appearance, though striking, is due to the relative preponderance of black in one and of white in the other variety. The dentition and the tendency to bipinnate branchiæ are strong points of resemblance. On the other hand, the differences found in both the African specimens are sufficient to constitute a well-marked variety. (1) Whereas the specimens from the Philippines are whitish with black stripes, these are black with white and yellow stripes. (2) The denticles on the teeth of the African specimens are fewer and finer and many of the teeth are smooth.

9. CHROMODORIS RUNCINATA B.

[Bergh, in S. R. xi. pp. 479-481.]

One specimen from Chuaka on the East Coast of Zanzibar.

The general colour of the living animal was light blue with many spots, some dark blue and some whitish yellow, on the back, tail, and sides, but not on the foot. Some of the yellow spots were arranged so as to form a rather irregular border at the sides of the mantle and a line down the middle of the back. The rhinophores and axes of the gills were a bright, light red. The gills were kept in motion.

The alcoholic specimen is high and stoutly built ; length 14 mm., breadth 5, height 6. The mantle is moderately ample ; under its posterior margin it bears eight conical protuberances, four of which are very distinct and the rest smaller. There are none, however, on the anterior portion of the mantle as in the specimens described by Bergh. The branchiæ are 12 and exposed in the preserved specimen. The foot is rounded in front and strongly grooved. The labial armature and radula are much as described and figured by Bergh. The formula of the latter is about $50 \times 70.0.70$. The teeth are bifid ; the innermost bear an accessory denticle on the inner side and hence appear trifid. The others bear two or three very fine denticulations below the two prongs. The outermost have 5-7 rather larger denticles.

A second specimen subsequently examined has also only a few conical protuberances behind and none in front, so that this peculiarity is perhaps characteristic of East African specimens.

10. CHROMODORIS NIGROSTRIATA. (Plate XXIV. figs. 5 & 6.)

Chromodoris nigrostriata Eliot, Abstr. P. Z. S. 1904, No. 4, p. 15, March 8.

One specimen from the mouth of Chuaka Bay, found among the branches of growing coral at extreme low tide.

The living animal was 15 mm. long and 3 broad when fully extended. The foot was broad and high ; the mantle-edge was narrow, and in the alcoholic specimen has become a mere low ridge. The ground-colour was a violet-blue grey, with rather ill-defined blotches of light primrose-yellow on the back, mantle-edge, and sides of the foot. On the back and sides of the foot were also very distinct curved black lines, one of which formed a horseshoe round the gill-pocket, while the rest were arranged in a nearly symmetrical figure. The edges of the rhinophore and gill-pockets were not raised. The gills were seven and completely retractile into a pocket which could close over them. The separate plumes were orange-red, but the rather large basal part, where they were all united, was of the same violet-grey as the body. The rhinophores were of a rather deep red.

The alcoholic specimen is of a uniform bluish grey ; the yellow blotches have disappeared, but the black lines are very distinct and vivid. The rhinophores are large, and of the seven gills three appear to be much larger than the others, which is not apparent from the drawings or descriptions of the living animal. The tentacles are entirely withdrawn and only indicated by two puckers, one on each side of the mouth. The front of the foot is round, and no groove is visible. The anterior part of the body has been torn, with the result that the buccal parts have been injured. The labial armature is a mass of thick stout hooks, shaped much as in Bergh's figure of *Chr. semperi*, arranged in a regular tessellated pattern. The radula, which seems small and brittle, is much damaged. No rhachis or rhachidian teeth are

discernible. All the teeth which I examined were hamate, with bifid tips, exactly like those of *Chr. semperi* as figured by Bergh.

Another specimen captured at Chuaka, on the East Coast of Zanzibar, seems to belong to the same species, though at first sight is strikingly different from the individual described above, being larger, stouter, and of another colour. The notes on the living animal describe it as lemon-yellow, with very deep purple-black stripes; the gills and rhinophores vermilion; the foot purplish underneath and at the edges.

The preserved specimen is pale yellow, with black lines arranged much as already described, including a horseshoe round the branchiæ, but shorter and more numerous. It is 30 mm. long, 15 high, and 13 broad. The mantle-edge is a narrow thick ridge, measuring 1.5 mm. at the sides, 2.5 over the head, and 3 over the tail, which is 10 mm. long. The body is high and thick, but the sole of the foot narrow (maximum 3 mm.). The pockets of the rhinophores and branchiæ are small and very slightly raised. The branchiæ are ten, set in a complete circle, but the anterior plumes are larger than the posterior. One of the latter is very small and perhaps merely an offshoot. The foot is rounded in front, grooved but not notched. The tentacles are retracted and hardly visible.

The labial armature is yellowish and formed of short thick hooks. The formula of the large and closely-packed but very fragile radula is about $90 \times 75.0.75$. The teeth are mostly bifid at the tip and otherwise smooth. Only the innermost have an accessory denticle on the inner side, and are thus trifid. The outermost are serrulate at the apex.

These two specimens seem to be merely colour-varieties of a single species which is closely related to *Chr. semperi* B. Except that the external teeth of the radula bear more numerous and more distinct serrulations, the principal characters appear to be identical. But whereas *Chr. semperi* is spotted, the animals here examined are marked with exceptionally clear and narrow black lines, which seem engraved on the surface. They must therefore be accorded specific rank, at least provisionally. It is possible that intermediate forms may be discovered, as the variety first described bears some yellow blotches.

11. CHROMODORIS SCURRA B.

Chromodoris scurra Eliot, Proc. Acad. Nat. Sci. Philadelphia, Dec. 1899, p. 518.

[Bergh, S. R. xi. p. 478, and Journal de Mus. Godeffroy, Heft vi. 1874.]

Two specimens from Zanzibar Harbour.

The colours of the living animal are brilliant. Down the centre of the back runs a white line, and on each side of it are borders in the following order: (1) narrow deep red line, (2) broad orange-yellow band, (3) narrow deep red line, (4) violet band, which broadens out anteriorly and posteriorly, (5) white border running

round the mantle. The foot is of a light violet-blue; the branchiæ orange with deep violet tips; the rhinophores uniform deep violet. The animals are sluggish and not very sensitive to touch.

The buccal parts and other characters are as described by Bergh. One specimen has six branchiæ, the other eight, of which one was posterior to the others and very small.

12. *CHROMODORIS HILARIS* B., var. (? = *lineata* Soul.)

[S. R. xvii. pp. 935-937.]

Nine specimens from Tundaa, Pemba, found on a sandy shore.

The description of the living animals is as follows:—"Creamy white. Foot and mantle edged with violet. On the back four undefined brown lines with three violet lines between. Foot projects behind mantle. Gills and rhinophores vermilion. About $1\frac{1}{2}$ inches long."

The preserved specimens are longish and not very stoutly built. The measurements of the largest are: length 25 mm., breadth 10 mm., and height 9 mm. The colour is the ordinary alcoholic yellow; on the back are traces of four brownish and three white lines, the latter representing the violet of the living animal. Some, but not all, of the specimens appear to have a similar white line on the sides of the body between the mantle and the foot. The branchial aperture is very small; the branchiæ themselves not very small and 10-12 in number. The foot is rounded in front and slightly grooved. The tentacles are distinct. The mantle-edge is of very varying shape, sometimes fairly wide and thin, sometimes merely a thick ridge.

The labial armature and radula are much as represented in Bergh's plates. The former is a grey ring composed of mace-like elements. The latter is small and transparent. Most of the teeth are bifid, with four or five accessory denticles below the two prongs. The innermost have one or two denticles on the inner side. The rhachidian thickenings are small and not very distinct.

Bergh's specimen was in life "hell ocker-gelb" with four bluish-black lines on the back, but on the whole the colour and markings are sufficiently similar to justify us in regarding the present specimens as merely varieties.

13. *CHROMODORIS LINEATA* Soul. (? = *Chr. hilaris* B.) (Plate XXIV. fig. 7.)

One specimen from the East Coast of Zanzibar.

The notes on the living animal are as follows:—"Cream-coloured. Gills and rhinophores vermilion. There were bright violet lines on the cream-yellow ground, bordering the foot and mantle: two along the sides of the body and five along the back. The two outside ones encircled the rhinophore-pits and joined in front; the median encircled the gill-pocket."

The alcoholic specimen is yellow and the violet lines have become white. It is high and stout, the dimensions being—length

15 mm., breadth 7, height 8. The mantle-edge is narrow except over the head, where it is ample. The branchial opening is minute; the branchiæ are small, 10 in number, and apparently set in a perfect circle. The foot is rounded and grooved in front; the shape of the head is spatulate. The labial armature is a yellow ring of mace-like elements. The radula is small and transparent, the formula being about $35.0.35 \times 80$. The ordinary teeth are bifid, and all appear to have four denticles under the top hook. The innermost have one or two denticles on the inner side. The outermost are irregularly serrate (*vide* Pl. XXIV. fig. 7). No rhachidian thickenings are to be seen.

Although the published plates of *Chr. lineata* and *Chr. hilaris* are remarkably different, the scheme of coloration is much the same; and I think it probable that the two forms are really varieties of one species.

14. CHROMODORIS ? LINEATA, var. NIGROLINEATA.

One specimen from Chuaka on the East Coast of Zanzibar.

The notes on the living animal are as follows:—"Shape spatula-like. Dorsal side whitish at edges, lemon-yellow medianly with longitudinal black lines. Gills and rhinophores short, orange-red. Underside colourless, but edge of foot and mantle bright dark blue (not purple)." Size 18 mm. long, 6 mm. broad.

The alcoholic specimen is of a waxy white. There are only faint traces of the blue borders, but there are five distinct black lines on the back, two of which are divided again so as to form long loops. The mantle-edge is thick and narrow. It measures about 2 mm. over the head and tail, but is hardly distinguishable at the sides. The anterior end of the foot is rounded and grooved. The small branchiæ are set in a circle and exposed. The buccal mass is small. The labial armature is transparent, and consists of rather irregular short hooks, some cleft. The small transparent radula is as in *Chr. hilaris*.

15. CHROMODORIS ? MAGNIFICA Q. & G., var.

One specimen from Zanzibar, dredged in 4 fathoms.

The following are the notes on the living animal:—"40 mm. by 10 mm. Elongate in form, fore end spatula-shaped. Colour white and rather translucent. Mantle with a thin yellow border, within which was a band of deep but brilliant violet, broadest in front and behind but broken laterally. There was also a violet line along the sides of the foot, and six longitudinal lines of deep chocolate-colour and different lengths along the back. They were surrounded by thin clear lines of opaque white. There was also a line of chocolate blotches along the side of the foot just below the shelf-like edges of the mantle. Branchiæ 10, simply pinnate, with a band of orange-red along each side of each plume. Rhinophores a deeper tint of orange. The tail projected well behind the mantle and bore chocolate blotches."

The alcoholic specimen is of a pale yellow, with the above-

described markings fairly well preserved but all white. The form is high and stout. The tail projects 6 mm. behind. The mantle-edge is narrow and very thick: it measures about 3 mm. over the head and tail, and 2 mm. at the sides. The pockets of the rhinophores and branchiæ are not at all raised. The front of the foot is rounded and grooved, the upper lamina being connected with the base of the tentacles; but, as in many other cases, it is hard to be sure that this feature is not due to contraction. The labial armature consists of two yellowish plates composed of rather large elements of varying size. The most perfect form appears to be a short thick hook, but in many cases this degenerates into a simple triangle. The formula of the radula is about $65 \times 70.0.70$. The teeth are crowded over the small naked rachis. They are of the bifid type, and have usually 3-5 denticles under the two prongs. These denticles are smaller in the inner half of the rows, where many teeth are quite smooth, and larger in the outer half. The innermost teeth have generally, but not always, a denticle on the inner side: the outermost are irregular and jagged.

The buccal parts of this animal ally it to *Chr. hilaris* and *Chr. carnea*, and its coloration is not altogether dissimilar to the former. I think it is probably the *Chr. magnifica* of Quoy and Gaimard, though identification is uncertain in the absence of information as to the radula of that species.

16. CHROMODORIS INCONSPICUA.

Chromodoris inconspicua Eliot, Abstr. P. Z. S. 1904, No. 4, p. 15, March 8.

One specimen from Zanzibar Harbour, dredged in 5 fathoms.

The living animal was translucent white, with numerous opaque white spots, and a few brown ones in the middle of the back; the rhinophores black; the gills greyish. It was stiff and sluggish, and somewhat resembled a *Phyllidia*.

The alcoholic specimen is of a uniform grey, 18 mm. long, 7 broad, and 6 high. The mantle-edge is narrow all round, including the parts above the head and tail, and is somewhat undulated. The pockets of the rhinophores and branchiæ have raised edges. The latter are small, 8 in number, and apparently set in a complete circle. The anterior end of the foot is slightly grooved. The tentacles are retracted. The labial armature is colourless, and consists of small thick hooks, sometimes bifid. The radula is also transparent. There are no rachidial thickenings. The innermost teeth are unusually broad and square; they bear 8 denticles inside and 7 outside. The next two or three are also broader than the rest, which are slender, erect, slightly hamate, with one or sometimes two almost vertical clefts, so that they appear bifid or sometimes trifid. Below these clefts are from 3 to 5 long distinct denticles on the outer edge. The outermost teeth are tall and slender, with 3 or 4 denticles on the apex, but otherwise smooth.

This form has many points of resemblance to *Chr. albo-notata* B., but the dentition seems different.

17. (?) CHROMODORIS FLAVA. (Plate XXIV. figs. 8 & 9.)

Chromodoris flava Eliot, Abstr. P. Z. S. 1904, No. 4, p. 15, March 8.

One specimen dredged on the West Coast of Zanzibar.

The living animal was 11 mm. long and 3 wide. The colour everywhere, including the rhinophores and branchiae, was a bright lemon-yellow. Round the mantle-edge ran a blood-red border of irregular width. The branchiae were six, simply pinnate, and with few pinnæ. The mantle-edge was undulated and ample. The back was flat. The foot projected about 2 mm. posteriorly, and was considerably expanded in front. (From the drawing it appears to be grooved but not notched.) The animal adhered very strongly. The tentacles were hardly visible, being merely two small blunt knobs on the snout.

The specimen has unfortunately been lost, but I give the figures.

Genus CASELLA (Cuv.).

This small group, though easily recognised by its clearly marked and much undulated mantle-margin, is not distinguished from *Chromodoris* by any features of importance, and there is no sufficient reason, except convenience, to maintain it as a separate genus. The chief character is the aforesaid undulation of the fairly broad mantle-edge, and the outermost teeth of the radula are smooth instead of being denticulate on the apex. Bergh recognises three species, all from the Indo-Pacific.

CASELLA ATROMARGINATA (Cuv.).

[Bergh, Jour. d. Mus. Godeffroy, vi. 1874, pp. 102-9; id. S. R. xvii. p. 942.]

One specimen from the West Coast of Zanzibar.

The notes describe the living animal as long and tapering, with a flat back and a mantle-edge only slightly projecting but elaborately wrinkled at the sides. The foot hardly extended beyond the dorsal area. The general colour was brown, with numerous small grey spots, but towards the edge of the mantle became first yellowish and then greenish. The mantle-edge itself was defined by a very distinct black border. The rhinophores were black, with a grey line on the edge of each lamella. The gills were black and grey, set in a double spiral and kept in motion. The animal was about two inches long, and, in spite of its sombre coloration, a handsome creature.

These characters and colours are well preserved in the alcoholic specimen. The mantle is narrow both at the sides and behind, and somewhat expanded only over the head. The branchiae are arranged in a double spiral meeting in front but leaving an open

space behind. They are 24 in number: those in front are fairly large, but the size diminishes backwards, and those in the spirals are extremely small. The head and anterior portion of the foot are much retracted, but the latter was apparently round and grooved in life.

The mouth leads into an unusually large and spacious cavity, but the buccal mass is very small, the radula minute, and the œsophagus extremely narrow. The labial armature is small but strong, with rough projecting teeth; the elements are small, yellowish, bent rods, mostly bifid. No rhachidian thickenings are visible; the innermost teeth have three denticles on the inner and about four on the outer side. The remainder have mostly five on the outer side only. The number of denticles increases towards the outside of each row, but the outermost teeth are smooth. The teeth are very small, crowded, and extremely numerous.

This specimen corresponds with previous descriptions of *C. atromarginata*, except that there are no thickenings on the rhachis of the radula and that the gills are much more numerous than in the specimens previously described. There seems to be some doubt on this point (see Bergh, Mus. Godeffr. l. c.), but the arrangement in the present specimen is perfectly clear. *Casella cincta* from Mauritius has 22 gills (Bergh, S. R. xvi. 2, p. 839), but presents differences in the coloration and buccal parts.

Genus CERATOSOMA, Adams & Reeve.

This genus is rendered unique among Nudibranchs by its extraordinary shape, but in its essential characters it is closely allied to *Chromodoris*. Indeed, if one looks at one of the high, stout Chromodorids (*e. g.* the figure of *C. semperi* in S. R. Heft xi. pl. lv. fig. 2), it will be seen that one has only to somewhat prolong the tail and to thicken and develop the mantle-edge in order to obtain the characteristic shape of *Ceratosoma*. The large strong radula is like that of *Chromodoris*, but the denticles are minute and inconspicuous. The branchiæ are much divided. Bergh recognises nine species, but I have only seen the descriptions of those examined by himself (*cornigerum*, *gracillimum*, *trilobatum*, *ornatum*, *polyomma*). In Zanzibar I have inspected more than forty specimens which are apparently referable to one species, and are connected together by numerous gradations in colour and shape, though the extreme forms look remarkably different. As the five species mentioned above are distinguished by their external characters only, and offer no certain differences in the dentition or other organs, I am inclined to think they are merely varieties and that there is only one real species. It is to be noted, however, that though many of my specimens resembled the figure of *Ceratosoma gracillimum* (S. R. pl. xxv. fig. 8) the border was never red as there depicted, but always violet, and in no case did ocelli occur as in *C. polyomma*.

CERATOSOMA CORNIGERUM *.

[Bergh, Semper's Reisen, x. pp. 393 ff.; id. 'Challenger' Reports, pt. xxvi. p. 80 ff.]

Numerous specimens of *Ceratosoma*, mostly found together and apparently belonging to one species, were captured at Chuaka in February 1901. About 40 of them were preserved.

The living animals varied greatly in coloration, the ground-tint ranging from olive-green to deep chestnut-red, with gradations in each shade. On this ground were numerous dark brown spots and white mottlings in varying proportions, but it is to be noted that the variations in the ground-colour were real and did not depend on the markings. In all specimens there were a row of violet dots round the foot, and violet lines or spots on the head near the rhinophores, and generally near the branchiæ as well. The ground-colour near the edge of the foot was white. One specimen was dark green with orange-yellow spots, and in all cases there were a few yellow spots near the edge of the foot and the genital orifices.

Many of the animals were found in shallow pools, crawling over seaweed and in no way hiding themselves. They were sluggish in their movements, and had a peculiar, unpleasant, strongly aromatic odour. In many specimens the tail or the posterior dorsal process appeared to have been bitten off. Possibly the curious shape may really be a protection to the animal by enabling it to escape with nothing worse than the loss of an unimportant part when it is seized by a carnivorous foe. No instances of self-mutilation were observed.

The alcoholic specimens show considerable variation in size and proportions. Some are stout, some slender with relatively longer tails; in some the lobes are much thicker than in others. Note was taken of one living specimen which had no lobes at all; another had two lobes like horns near the rhinophores. It does not appear that these variations in size and shape correspond with any differences in the radula, branchiæ, or other organs.

The measurements of an average fine specimen are as follows:—Total length 89 mm., tail 34 mm.; extreme height to tip of posterior lobe 33 mm., extreme breadth across lateral lobes 26 mm. The posterior lobe rises 10 mm. above the level of the back, and the lateral lobes project 6 mm. from the line of the sides. The pockets of the rhinophores and branchiæ have slightly raised rims in some specimens, but not in all. The rhinophores are rather large; the club bears about 40 perfoliations on each side, and is supported on a stalk about as large as itself. The branchiæ are long and string-like; in nearly all the specimens they project from the pocket and are not retracted. The arrangement is

* In my paper on Mr. Gardiner's collection of Nudibranchiata, in the 'Fauna and Geography of the Maldives and Laccadive Archipelagoes,' I inadvertently alluded (p. 552) to *Ceratosoma polyomma* as common in East African waters. I should have said *C. cornigerum*.

variable, and does not lend itself to expression in a formula. In most of the larger specimens it is somewhat as follows:—All the branchiæ rise from a ring which forms the common support; in front and behind (where it is united with the anal papilla) it is about 4 mm. high. From it rise in front three longish separate plumes, bifid or trifid at the tip. On each side is a group of about five plumes, united together by a common portion some 6 mm. high; each plume is divided into three or four subdivisions, and each of these subdivisions is branched again.

The anterior margin of the foot is deeply grooved, but so retracted in most specimens that it is hard to see. The tentacles are also generally retracted. The buccal mass is a large elongated yellow cone, and the retractor muscles are very conspicuous. The labial armature is composed of small slender hooks, rather irregular in shape but not bifid. The large radula is supported by a stiff strong membrane, from which the teeth are not easily detached. In the larger specimens the formula is about $150.0.150 \times 70$. There is a slight rhachidian fold. The innermost teeth have one denticle on the inner side and 3 to 4 on the outer. The rest bear 1–3 inconspicuous denticles on the outer side only, of which the highest is the largest. The outermost teeth are degraded, but not much serrulated. In one specimen a number of irregular teeth, bifid and variously jagged, occurred in the middle of several rows. The rest of the internal organs appeared to be as described by Bergh. There is hardly any dilatation which can be called a stomach before the digestive tract enters the liver.

Genus SPHERODORIS.

This genus is characterised by its peculiar dentition, simply pinnate branchiæ, and the external conformation of the mouth-parts. In outward appearance the species differ greatly, for whereas *punctata*, *papillata*, and *verrucosa* bear ridges and warts, *lævis* is smooth. Bergh classes the genus with *Orodonis* and *Miamira*, apparently on account of these warts and ridges; but it appears to me to be more nearly allied to *Chromodoris* in virtue of its simple branchiæ and its dentition, which is substantially similar, although it has peculiarities of its own. The teeth are straight, long, and thin, with a comb-like denticulation. The innermost are broader than the others and divided into two parts, one of which is smooth and the other denticulate—an arrangement which is perhaps analogous to that of *Chr. mörchii* and *Chr. gonatophora*, where the innermost teeth have one large smooth denticle on the inside and several small ones on the outside, although in *Sphærodoris* it would appear that the smooth part of the tooth corresponds to the outside.

Four species are known, all from the Indo-Pacific.

SPHÆRODORIS LÆVIS, var. *VARIEGATA*.

[Bergh in Semper's *Reisen*, Heft xvii. p. 924, 1890.]

One specimen from Mnemba on the East Coast of Zanzibar, found in the act of laying a ribbon of light violet-coloured eggs. The body of the living animal was described as firm and shiny, dark brown in colour above, with greenish and sandy patches; the underside was a lighter shade of uniform brown.

The alcoholic specimen is 31 mm. long, 20 broad, and 14 high. The foot, which is nearly as large as the body, is 28 mm. long and 15 broad. The colour is mottled-brown of darker and lighter shades. There are also bands formed of minute black spots, not very conspicuous, and arranged in an irregular pattern, particularly in the neighbourhood of the branchial opening. Though the dorsal surface cannot be described as either tuberculate or papillose, it is not, strictly speaking, smooth, but bears low irregular excrescences which resemble a marine growth. Also, there are about 10 shallow pits (? glandular) distributed at irregular intervals round the mantle-edge. Like the bands, they are inconspicuous, about 1 millimetre wide, with slightly raised edges and a black centre. The edges of the rhinophore and branchial pockets are not much raised and entire. There are 14 small but stout, simply pinnate gills, set in a circle which is slightly open posteriorly. The head is joined to the upper lamina of the foot at the sides, and there are no distinct tentacles, though two small prominences by the mouth may represent these. There is a very narrow but strong labial armature, composed of minute hooks. The radula is rather narrow, with a wide naked rhachis. There are about 70 rows, each containing about 25 teeth on either side of the centre, but the teeth mostly point towards the rhachis, and the whole arrangement is very irregular so that the usual radula formula hardly meets the case. The teeth present the form characteristic of the genus, but the innermost are somewhat wider than Bergh's figures of *S. lævis* (*l. c.* pl. lxxxviii.) and bear 7 or 8 denticles. The denticles on all the teeth are extremely delicate and fine. There is no stomach apart from the hepatic mass. The reproductive apparatus is unarmed.

This form is clearly a *Sphærodoris* (as shown by the buccal parts, head, and branchiæ), and, equally clearly, neither *S. punctata*, *papillata*, nor *verrucosa*. It undoubtedly comes very near to *S. lævis*, of which I provisionally describe it as a variety, but it varies somewhat from the type specimen described by Bergh both in the pits, which he does not mention, and in the teeth, and may prove to be a new species.

I have also examined several individuals, apparently referable to *S. lævis*, captured by the Skeat Expedition at Pulau Bidang near the Malay Peninsula. Their dentition is like that described above, and they have a few (in one specimen only two) pits, but the back is quite smooth and of an almost uniform bluish olive colour.

Since writing the description of this species I have examined another specimen, found at Mombasa at low tide. It is strongly arched, and of a sandy-brown colour with patches of darker brown. Near the branchial opening are a few bands of minute black spots, almost invisible except under a lens. On the dorsal surface are 22 pits, scattered quite irregularly round the margin and in the middle. The preserved specimen has a small ridge between the rhinophores, not extending before or behind them, and possibly due to contraction after death. Around the branchial pocket is a circular area, marked off from the rest of the back by being somewhat flatter and lighter in colour. This feature was not found in any of the other specimens.

Genus ORODORIS.

This genus, which Bergh regards as allied to *Miamira*, has the oval shape, wide mantle-margin, and tripinnate branchiæ of an ordinary Dorid. The dorsal surface bears ridges and tubercles. The mouth-parts show some affinity to *Chromodoris*. There is a labial armature composed of bent rods, and the rhachis of the radula presents thickenings. The innermost teeth are denticulate on both sides, the next few on the outer side only, and the rest are smooth.

ORODORIS MIAMIRANA B.

[Bergh, "Neue Nacktschnecken," Jour. Mus. Godeffroy, Heft viii. 1875, pp. 67-71.]

One specimen from New Britain, kindly given me by Dr. Willey. It is, as preserved, of a uniform olive-green, with a few white spots on the foot and underside. The length is 58, the breadth 32, and the height 26 mm. The foot does not project beyond the mantle; it is deeply grooved in front and is broad, measuring 15 mm. across without counting the margins, which are turned inwards. The dorsal surface is arched, and the greater part of it is covered with composite tubercles. Over the head and round the edge of the mantle are many smallish tubercles roughly arranged in three rows. There is one large tubercle somewhat resembling the terminal lobe of *Miamira* over the tail, but no corresponding formation at the other end. Down the middle of the back runs a thick ridge, in which is set the large branchial opening. It bears six tubercles, one rather small one between the rhinophores, then two more small ones, followed by two large ones; then comes the branchial pocket, and behind it is another large tubercle. From this central ridge three transverse ridges, also composed of compound tubercles, run to the sides. The branchial pocket has a raised rim roughly circular but wavy in outline. Bergh gives the branchiæ as 7; in this specimen there are three on each side, an open space behind, and in front a very broad plume with a small accessory plume at its side. The anal

papilla is very large and connected with the front branchia by a membrane, from which an accessory membrane runs to the accessory branchia. The rhinophores are protected by raised tubes about 4 mm. high and covered with tubercles. The external opening of the mouth is unusually large. On each side of it is a conical well-developed tentacle pointing laterally.

The internal organs correspond with Bergh's description. There is a moderately large stomach with membranous walls, almost entirely enclosed in the liver, there being no dilatation whatever in the digestive tract before it enters this organ. Within the liver the cavity of the stomach measures about 6 mm. across, and the intestine when it issues is nearly the same size.

Genus MIAMIRA.

This curious form is of very uncertain affinities. Its elongate shape and labial armature seem to ally it with *Chromodoris*. But the teeth are uniform and hamate, without denticulations, the back bears ridges and tubercles arranged in a regular pattern, and the branchiæ are tripinnate. A unique character is presented by the lappets on the mantle-edge, with gill-like lamellæ on their underside.

MIAMIRA NOBILIS B.

[Bergh, "Neue Nacktschnecken," Jour. Mus. Godeffroy, Heft viii. 1875, pp. 53-63.]

Two specimens from New Britain given me by Dr. Willey. In one (hereafter called the first specimen) the tubercles and lobes are much ampler and more elaborately divided than in the other (or second specimen), so perhaps the two forms correspond to the typical species and variety described by Bergh. But the colour of both is the same—olive-green with a few white spots on the lower parts, and there is no difference to speak of in size. The length is 40 mm., the breadth 14, and the height 18. Down the middle of the back runs a ridge which bears obscure indications of being three ridges fused into one. It is about 6 mm. high in the first specimen, and 2 mm. in the second, and in both bears four tubercles. From the point where these tubercles arise, transverse ridges run at right angles to the side of the body and terminate each in a lateral lobe. The mantle-border is marked by a double ridge. There is a veil-like lobe over the head, which is trifid in both specimens, and another over the tail, which in the second specimen is small and simple, but in the first very large and studded with many accessory tubercles. At the sides of the body are four lobes, three in front of the branchiæ and one behind. The lateral and terminal lobes bear lamellæ on their underside in both specimens, but in neither are there any under the head-lobes. The branchial pocket is at the end of the dorsal ridge, raised and irregularly tuberculate. In the first specimen there is a very

large posterior tubercle. The openings of the rhinophores have slightly raised but smooth edges; the rhinophores themselves are long, straight, and thin, and bear about 30 perfoliations. The tripinnate branchiæ appear to be nine in number, but are so deeply cleft that it is hard to say how large a group should be taken as the unit. The foot is narrow and not very clearly marked off from the head; it is distinctly but not deeply grooved in front. The internal anatomy is as described by Bergh. Both the labial armature and the radula are bright yellow. The former consists of small rods, straight or bent, but in all cases hooked at the end and not bifid. The teeth of the radula are somewhat irregular in shape, but no denticulations are discernible; the innermost teeth close over the rhachis. The œsophagus widens out into a distinct dilatation before entering the liver.

EXPLANATION OF THE PLATES.

PLATE XXIII.

- Fig. 1. *Chromodoris reticulata* (p. 386). Anterior end, showing relations and proportions of head, foot, and mantle. *a*, ridge connecting head and foot; *b*, groove in anterior edge of foot; *m*, mouth.
2. Diagram of the arrangement of the gills, the positions of which are shown by transverse sections of their bases: *a*, anus.
3. A single gill cut across, showing *r.*, rachis; *b.v.*, blood-vessels; and *p.*, portions of three of the pinnæ borne on the sides of the rhachis.
4. Portions of the radula. *a*, central teeth; *b*, the form of the majority of the teeth; and *c*, those intermediate in shape and position between *a* and *b*.
5. The alimentary canal. The liver is cut away and the stomach laid open.
- | | | |
|---|-------------------------------------|---|
| <p><i>b</i>. Buccal mass.</p> <p><i>g</i>. Gills.</p> <p><i>l</i>. Cut surface of liver.</p> <p><i>ld</i>. Ducts of liver opening into stomach.</p> | <p> </p> <p> </p> <p> </p> <p> </p> | <p><i>sal</i>. Salivary gland of right side.</p> <p><i>st.c</i>. Thin-walled anterior diverticulum of stomach.</p> <p><i>st.m</i>. Muscles in stomach-wall.</p> |
|---|-------------------------------------|---|
6. *C. sykesi* (p. 387). A living example.
7. *C. cavæ*, from life (p. 388). *m*, edge of mantle; *f*, edge of foot.
8. Diagrams of the arrangement of the gills. *a*, from an example which had 16 gills; *b*, from one with only 12.

PLATE XXIV.

- Fig. 1. *Chromodoris annulata* (p. 389). Central teeth of radula.
2. Diagram showing positions of bases of gills: *a*, anal papilla.
3. A living example. The purple border of the mantle is continuous all round, but is in this case hidden in places by the folding down of the free mantle-edge.
4. *C. elizabethina*, var. *africana* (p. 392).
5. *C. nigrostriata* (p. 394), dorsal view.
6. Side view of the same. (The number of branchiæ was in reality seven, not nine as here depicted.)
7. *C. lineata* (p. 396). Teeth of radula: *a*, from outer, and *b*, from central part.
8. *C. flava* (p. 399). Living specimen. *a*. Anterior corners of foot, which may or may not project beyond mantle-edge (*cf.* fig. 9).
9. Ventral view of the same showing narrow foot with its prolonged anterior corners and transverse groove, and proportions of head and mantle.





C. Crossland, del.

Huth, sc. et imp

1-3. *CHROMODORIS ANNULATA*. 4. *C. ELIZABETHINA*.

5, 6. *C. NIGROSTRIATA*. 7. *C. LINEATA*. 8, 9. *C. FLAVA*

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On some Nudibranchs from East Africa and Zanzibar.
Part V.* By Sir C. ELIOT, K.C.M.G., late H.M. Commissioner for the East African Protectorate, F.Z.S.

(Plates III. & IV. †)

In my last two papers I treated of the Dorididæ Cryptobranchiata as a group, but no systematic importance is to be attached to the order in which the species now to be described are arranged.

PTERAEOLIDIA SEMPERI.—Since writing my description of this species in my second paper (P. Z. S. March 17, 1903, p. 255), I have read Prof. Bergh's account of *Nossis*, characterised by a lateral ridge similar to that found in some of my specimens ('Opisthobranchiata of Danish Expedition to Siam,' 1899-1900, p. 52), and accordingly carefully re-examined them to see if they should not be referred to this new genus. It appears that they should not. The radula is uniseriate, consistently of 18 teeth, and the same in the specimens which have and those which have not the lateral ridge. It therefore seems clear that the ridge is found in the genera where the radula is uniseriate as well as in those where it is triseriate, and, further, that in alcoholic specimens, at any rate, it may be present or absent in the same species.

* For Part IV. see P. Z. S. 1904, vol. i. p. 380.

† For explanation of the Plates, see p. 105.

NOTODORIS Bergh.

[Bergh, "Neue Nacktschnecken d. Südsee," p. 111, in Jour. d. Mus. Godeffroy, viii. 1875; Eliot, Nudibranchiata in J. S. Gardiner's Fauna and Geography of the Maldive and Laccadive Archipelagoes, vol. ii. part 1.]

This genus, which is recorded from three parts of the Indo-Pacific, seems allied to *Egires* and the little-known *Triopella*, with which it forms a small group of phanerobranchiate Dorids characterised by a hard texture, valves or other appendages protecting the gills, and undifferentiated teeth. Both *Egires* and *Notodoris* have simple unperfoliate rhinophores.

The body of *Notodoris* is hard and rough, often marked with prominent ridges. The frontal veil is large. The branchiæ, and sometimes the rhinophores, are protected by valves. There is no labial armature, and the teeth are hamate with indications of an accessory denticle. Three species have been described, each from a single specimen—*N. citrina* B., *N. gardineri* Eliot, and the present *N. minor*. They are all yellow, differing chiefly in size, shape, and the form of the branchial valves. It is just possible that *N. minor* may be a young and undeveloped form. It is smaller than the others, and superficially resembles a *Phyllidia*. It has no distinct tail, no rhinophore valves, and no longitudinal ridges. The branchial valve is three-lobed and not much subdivided. Possibly the gill is constructed differently from those of other species. Both *N. citrina* and *gardineri* have rhinophorial valves and a body tapering off into a tail: the former has a single dorsal ridge running from the rhinophores to the branchial valve, which is eight-lobed: the latter has four dorsal ridges and a branchial valve three-lobed, with elaborate subdivisions.

NOTODORIS MINOR, sp. n. (Plate III. figs. 1 a–1 g.)

One specimen from Chuaka, east coast of Zanzibar.

The living animal was 13 millimetres long, 5 broad and 4 high. It was light lemon-yellow in colour, with sharply-marked transverse black lines. The flat sole occupied the whole ventral surface. The back was not quite smooth, the yellow parts being really low broad lumps between black depressions. The whole body was very stiff and rigid, superficially resembling a *Phyllidia*. The animal was never seen to move.

In the preserved specimen the yellow has become whitish, but otherwise the shape and markings of the living animal are preserved. The integuments are very hard and full of spicules. There is no trace of any mantle-edge, and the body slopes straight down to the sides of the foot. Over the mouth-parts is a strong rounded frontal veil (figs. 1 a & 1 e), also descending right down to the sides of the foot, and extending laterally about as far as the rhinophores. At the beginning of the posterior third of the body are the three gill-valves (figs. 1 a–1 c). They are not noticeable except in profile, as they lie rather flat, and are not much subdivided. Beneath them lie the gills (fig. 1 d), which appear to

consist of about 27 small tufts, pinnate, bipinnate, or tripinnate according to their size, and spread over three areas corresponding to the valves. Possibly each area represents a separate axis, and the gills should be described as three tripinnate or quadripinnate plumes. But this arrangement cannot be demonstrated with certainty in the preserved specimen, and the living animal never raised the valves at all. The rhinophores are thick, conical, and without a trace of perfoliations; they are retracted into simple holes, provided with neither valves nor raised edges. No oral tentacles and no groove in the anterior margin of the foot could be discovered (fig. 1e).

There is no trace of armature on the labial cuticle. The radula consists of 33 rows, the largest of which contain about 25 teeth on each side of the rhachis. The teeth are transparent and crowded: the innermost are smaller and close over the rhachis; the outermost are longer and show no trace of irregularity. The shape of all is much the same, hamate with a rudimentary denticle under the tip of the hook. They much resemble the teeth of *Notodoris citrina* (Bergh, *l. c.* pl. ix. figs. 39, 40), but are somewhat more erect and hardly ever show indications of more than one denticle (fig. 1g). The glans penis spreads out somewhat as in *Nembrotha*, and appears to be trifid. The lower part is armed with a thick mass of minute blunt spines (fig. 1f).

TREVELYANA Kelaart.

[Kelaart, in *Ann. Mag. Nat. Hist.* 3rd ser. vol. i. p. 257, 1858; Bergh, in *Semper's Reisen*, Heft xi. p. 441, & xvi. 2, p. 850.]

This genus is recorded only from the Indo-Pacific, where it seems to be the commonest representative of the Polyceradae, being frequent under stones between tides. The animals are limaciform, but some specimens at any rate show indications of a division between the back and sides. The body is smooth, bears no appendages, and is usually of a light bright colour varying from red to white. The branchiae are rarely less than ten, often numerous, and generally small. There is no labial armature or central tooth. The radula is fairly wide, and composed of hamate or awl-shaped teeth, which are often irregular. The hermaphrodite gland, instead of being spread over the liver, is collected into two globular masses.

Several of the species, *e. g.* the *T. ceylonica* and *T. bicolor* given below, are very imperfectly described by the original authorities, and hence identification is uncertain. It is clear that the whitish forms with yellow lines and spots show considerable variety, but it is hard to say how many of these varieties are specific.

TREVELYANA COCCINEA, sp. n. (Plate III. figs. 2a-2f.)

One specimen, dredged between Shimoni and Wasin at 6-8 fathoms.

The notes on the living animal describe it as the largest species

of *Trevelyana* yet found in East Africa, 3 inches long, and stout in proportion. The colour was bright vermilion, plentifully besprinkled with slightly projecting spots of a deeper shade. The rhinophores and gills were small and deep vermilion in colour.

The preserved specimen has greatly shrunk, and is 25 millimetres long, 14 high, and 11 broad. The colour is dirty white, and no spots or tubercles are visible. There is no trace of tentacles or of a mantle-edge, but the frontal veil is a distinct hard ridge. The foot is grooved in front. The tail is very short. There are 12 small gills set in a circle, bipinnate and in parts tripinnate. The vent is subcentral and not raised.

Though there is nothing that can be called a labial armature, the labial cuticle is strengthened with scattered rods of various shapes. The radula is larger than usual in the genus. It consists of 36 rows, some of which contain as many as 51 teeth, so that the formula is $36 \times 50 + 1.0.1 + 50$, but the rows towards the front are much smaller. The first lateral is large and hamate (fig. 2*a*), sometimes with irregular notches or denticles on the outside of the hook (figs. 2*c* & 2*d*). In several cases the top seemed to be broken off, and the remaining part was bifid or trifid (fig. 2*b*). The other teeth are slender and hamate (figs. 2*e* & 2*f*). In all the teeth the hook is directed forwards, not backwards.

The liver is greyish and not very large. In front of the liver, but quite separate from it and from one another, lie two large spherical hermaphrodite glands with a diameter of about 5 and 7 millimetres respectively. They are yellowish in colour, and the surface is covered with knob-like follicles. The verge is armed with transparent spines. The large pericardium lies in front of the branchiæ, and in the alcoholic specimen is much inflated.

This form is possibly the *Stenodoris rubra* of Pease (Am. Journal of Conch. ii. 1866, p. 206), though, if so, "light red papillæ" is a strange description of the raised spots; but the account given of the animal is not sufficient to admit of identification.

TREVELYANA CEYLONICA Kel. (Plate III. figs. 3*a*–3*c*.)

[Kelaart, Ann. & Mag. of Nat. Hist. 3rd ser. vol. i. p. 257, 1858.]

One specimen from the East Coast of Zanzibar.

The notes on the living animal describe it as about an inch long, creamy white, with bright red dots. The gills were yellow, with bright red lines down their backs; larger and more feathery than is usual in the genus. There was a line of bright red round the edge of the foot.

The preserved specimen is colourless, 15 millimetres long and 6.5 broad. The back is quite smooth, and there is no sign of a mantle-rim. The pericardium forms a large, much swollen prominence. The rhinophores are completely retracted. There are 12 branchiæ set in a circle open behind; one is large and bifid, one is rudimentary. The foot is deeply grooved in front. No tentacles could be discerned.

The buccal mass is rather large, the radula fragile, with a wide rhachis. There are 21 rows in all, some of the longest of which contain 24 teeth on each side. The first tooth (fig. 3 *a*) is larger than the rest, and projects into the rhachis; it is slightly bent, but hardly hamate. All the first teeth are similar and regular in shape. The base is somewhat wavy and as if hollowed out. The other teeth are awl-shaped, with an irregular and somewhat bifid base (fig. 3 *c*). The liver is yellowish grey and not very large. In front of it are two hermaphrodite glands, much as in *T. coccinea*, but smaller. The verge is armed with numerous short thorns of very varying shape.

I think this animal is probably Kelaart's *T. ceylonica*, for which the genus was founded, and which appears not to have been described since; but it is difficult to be certain of the identification, as he gives no information respecting the radula. The form and colour agree well, including the red lines on the branchiae and round the foot. The chief difference is that whereas his specimen has 15-16 pure white branchiae "set round a large disk," mine had 12 yellow branchiae set in a circle open behind. But his specimen was nearly twice the size of mine, and probably the larger individuals develop extra plumes which close up the posterior gap. On the other hand, both specimens agreed in having rather large feathery branchiae, an unusual character in the genus. Kelaart says "they resemble a small tuft of marabout feathers."

TREVELYANA CROCEA B. (Plate III. fig 4.)

[Bergh, in Semper's Reisen, xvi. 2, p. 850, figs.]

More than 100 specimens from the East and West Coasts of Zanzibar, where it is one of the commonest littoral molluscs at certain seasons.

Mr. Crossland, who collected them, informs me that this form provided a most striking case of the migration of molluscs in flocks to shallow water for the deposition of spawn.

But few specimens were collected before a certain period of a few days' duration, when the sand of Chuaka Bay just below low-tide mark was occupied by astonishing numbers of these delicate little nudibranchs. These were not washed up by accident, but were all actively crawling on the sand among the weeds &c. Many were *in coitu*, and when placed in basins of sea-water most of the specimens were soon engaged in copulation or the deposition of yellow egg-ribbons. By-and-by the swarm disappeared to some unknown permanent habitat. If this were in the deeper channels of the bay (1 to 2 fathoms deep at low tide) they must have been found there by dredging. As this was not the case, it seems most probable that the migrations of these tiny animals extend to and from the deep sea three or more miles away. An almost equally conspicuous swarm was formed by individuals of *Melibe fimbriata*, and other species (e. g. *Ceratosoma cornigerum*, *Chromodoris* spp., and *Pleurobranchus delicatus*) appeared occasionally for a few days in considerable

smaller numbers, being rare or completely absent from the shore of the Bay at other times.

Most of the animals were of a bright dark yellow with the black liver showing more or less conspicuously through the transparent integuments, but the colour ranges in exceptional cases from deep orange to almost colourless transparency. Many specimens were infested with small light yellow copepoda found adhering to the body, especially on and near the gills.

The alcoholic specimens are of a more or less yellowish white. The largest is 29 millimetres long, 12 high, and 8 broad, but, as a rule, the back is proportionately broader. The whole body is smooth and very soft. In most specimens the dorsal area is bounded by a distinct lateral ridge. It is not visible behind the branchiæ, but extends from them to the front of the head, where, however, it is not continuous but divided by a deep notch in the middle. In several specimens this ridge is only clear in places and in a few it is absent altogether. The rhinophores bear about ten perfoliations and are set in such shallow pits that they can hardly be called retractile. They are exposed in the alcoholic specimens. The edges of the pits are smooth. The gill consists of from 20 to 34 leaflets*, set in a horseshoe or circle open behind, and placed rather far back. The leaflets are flat and compressed and decrease in size posteriorly. The largest bear on each side about ten lamellæ, the smallest two or three. The whole appearance of the branchial apparatus is quite unlike what is usual in the circum-anal plumes of nudibranchs and recalls the prosobranch gill. The foot is a narrow groove, but has a thin expanded margin, including which the breadth is 6 mm. in large specimens. The anterior margin of the foot is grooved and united with the corners of the mouth, where it is joined by a second ridge, which runs above it and apparently represents the tentacles. The tail is bifid.

The radula has a wide bare rhachis, and the formula varies from about $11 \times 10 + 2.0.2 + 10$ to $15 \times 14 + 2.0.2 + 14$. The innermost tooth is irregular in shape, but consists of a basal portion from one end of which rises a more or less bent spine, while another spine is more or less completely developed at the other end. The second tooth is larger and is more distinctly bicuspid. The other teeth are unicuspid, awl-like, and hardly bent; and those nearer the rhachis are rather stout, but they become slender towards the end of the row. All the different forms of teeth are well represented in Bergh's plates. In the nervous system the ganglia are very distinct. The liver is large, black, and very soft. On its anterior portion, and less detached from it than usual in the genus (*e. g.*, than in *T. coccinea* described above), are two yellowish hermaphrodite glands of a somewhat irregular shape. Indeed, though separable from the liver, they cannot be said to be separate from it. This may be possibly due to the fact that the specimens are in good condition, so that the membranes connecting the

* The gills as represented in the Plate are not sufficiently numerous.

various organs are fresh and strong, whereas in other cases they may have dried up or decayed. The verge is armed with numerous small spines of very variable shape, simple, bifid and trifid. From the genital mass to the tail extends on each side a long, ramified, almost arborescent gland, distinctly visible through the transparent body-wall with which it is united.

TREVELYANA BICOLOR (?). (Plate IV. figs. 1 a-1 c.)

[A. & H., Notes on a Coll. of Nud. Moll. made in India, p. 132, pl. xxix. figs. 11, 12.]

The single specimen, which was captured at Prison Island, Zanzibar, was 20 millimetres long, with a very long narrow foot, tapering to a point posteriorly. The whole animal was white, with projecting spots of bright yellow. The tips of the rhinophores and edges of the gills were also bright yellow. The liver showed through the dorsal integuments as a black mass before and behind the branchiæ, and in front of it were seen the yellow reproductive organs. The branchiæ were simple and leaf-like and shrunk together when touched.

The preserved specimen is contracted into a spherical shape, showing no trace of the raised spots or of a mantle-margin. The head-parts are much retracted and distorted, but the anterior margin of the foot seems to have been deeply grooved. The colour is white, but the black liver is still conspicuous. The twelve branchiæ are set in a complete circle.

The radula consists of 26 rows, the widest of which contain 24 closely packed teeth. The first lateral is large and hamate and the next much like it. The other teeth are rather stout, of the bradawl shape or slightly curved. In the pharynx were found the remains of a small tectibranch, which, to judge from its radula and stomach-plates, was probably *Atys*.

I think this form is probably A. & H.'s *T. bicolor*. Their description was made from the drawing which they reproduce and they saw no specimen. The bicoloration there depicted was probably due to the liver being seen through the integuments, for though the picture certainly suggests a black patch on the skin, it will be seen that this patch occupies exactly the position of the liver, and that it bears yellow spots like the white part. It is also possible that Rüppell and Leuckart's *T. impudica* is identical with this form. They describe it (Neue wirbellose Thiere des rothen Meers, p. 33) "corpore dilute lacteo; tentaculis superioribus, maculis ocellisque dorsalibus, branchiis pedisque limbo aurantiacis; dorso tuberculato; branchiis 12 medium dorsi versus sitis; pallio indistincto."

NEMBROTHA B.

[Bergh, S. R. xi. p. 450, figs., xvii. p. 980, figs.; id. Beitr. zu einer Monographie der Polyceraden, ii. p. 658, figs., and iii. pp. 164-5.]

This genus is allied to *Trevelyana*, but both internally and externally can be readily distinguished from it. The coloration is

generally rather sombre but gorgeous, a prevalent tint being very dark green or blue with brilliant lighter markings. The gills are few (3-5), but large and strong. The hermaphrodite gland is as usual, and not collected into globules. A very narrow labial armature is present in some species, but usually there is none. The radula is never very wide and sometimes is very narrow, consisting of a median plate with from three to twelve laterals, of which the first is large and hamate and the rest plate-like. The species are not all equally well known, all our information as to *N. morosa* and *cristata* coming hitherto from drawings by Semper. It would appear, however, that some of my specimens should be referred to the latter species. *N. nigerrima*, *kubaryana*, and *cristata* have a fairly broad radula, with about twelve laterals, and are distinguished by their dark coloration. They are evidently closely related, and may prove to be merely varieties, including *N. morosa*. *N. gracilis*, *diaphana*, *gratiosa*, and *affinis* are lighter in colour, and have a narrow radula with only three or four laterals.

Nembrotha is recorded from the Indo-Pacific and West Coast of Mexico. It is fairly common on the East Coast of Africa.

NEMBROTHA CRISTATA B. [?= *N. nigerrima*, var.] (Plate IV. fig. 2.)

[Bergh, S. R. xi. p. 458, pl. xxxiii. fig. 6.]

Three specimens from the East Coast of Zanzibar. The living animals are described as having a sloping back, long tail, and narrow foot, somewhat like *Ceratosoma*. The texture was soft, and the colour a very dark but brilliant green with black spots, and also narrow stripes of brighter and lighter green. The gills were counted as five, and the rhinophore-pockets were raised.

The measurements of the largest alcoholic specimen are : length 54 millimetres, breadth 15, height of body 13, height of branchiæ above body 8. The texture has become hard and wrinkled, the animals having evidently been strongly contracted. The main stem of the gills is very thick, strong, and muscular, so that it almost forms a valve to protect the pinnæ as in *Notodoris*. The anterior plume is distinct and separate, but the lateral pairs are almost confluent, and it is consequently hard to say where one begins and the other ends, or whether the total number of branchiæ should be reckoned as three, four, or five. The rhinophores are not very large and are completely retracted within smooth projecting sheaths about 2.5 mm. high. The foot is narrow. The relations of the external mouth-parts are much obscured and distorted by the strong contraction which has affected the whole anterior portion of the body, but it appears probable that the foot is grooved and notched with the upper lamina attached to the corners of the mouth, and that the tentacles are horizontal ridges. There is a very narrow labial armature, about half a millimetre wide and hardly visible to the naked eye. It appears to form a complete ring, and is composed

of a loose mass of long, yellow, transparent rods, irregular in shape and often bent.

In the two specimens dissected, the radula consists of 30 and 31 rows respectively, and the formula of each row is, as a rule, $10+1.1.1+10$ or more rarely $11+1.1.1+11$. The median tooth is squarish, not very broad, and bears, as a rule, five denticles on the anterior edge, but sometimes only four, while in one specimen there were only three denticles in the hinder rows. The first lateral tooth is large and sickle-shaped. The corner of the basal part projects over the rhachidian tooth and creates a false impression that it is an accessory denticle. The remaining teeth are generally ten, but sometimes an additional rudimentary one at the end of the row raises the number to eleven. They are little more than flat squarish plates, decreasing in size outwards. Only the first of them shows some traces of a hamate shape.

All the internal organs are of a deep black colour, which rendered their examination difficult. The blood-gland is large. I was not able to make any satisfactory preparations of the reproductive organs, but the glans seemed to be armed with a dense mass of curved rods.

I think this form must be identified with *N. cristata* B., of which, however, no specimen has been described, all that is known of it being Semper's drawing and apparently a few notes. But it is also not improbable that it is a variety of *N. nigerrima* B., from which it differs externally in little except the absence of any red coloration. The number of branchiæ is, as explained, uncertain, but the arrangement shown in Bergh's plate of *N. nigerrima* is certainly not that of these specimens. On the other hand, the presence of the narrow labial armature is an argument for identity.

NEMBROTHA CÆRULEA, sp. n.

Four specimens from Sii Island, near Vanga. No notes on the living animal, except that it was blue and had apparently no red or green mottlings.

The colour of the freshly-preserved specimens was a fine bright indigo, varying in intensity in different parts. One of the specimens was much lighter than the others and also smaller. The whole of its body and the lighter parts of the other individuals were marked with deep indigo spots.

The largest preserved specimen is 43.5 millimetres long, 18 high, and 12.5 broad. The space from the head to the branchiæ is 12 mm. and from the branchiæ to the end of the tail 22 mm., but the tail is longer in this specimen than in the others. The shape is somewhat like that of *Ceratosoma* without lobes, as the back rises considerably from the head to the branchiæ. The integuments are leathery and not at all transparent. The surface is quite smooth, and there is no indication of a mantle-edge. The rim of the rhinophore-pockets is only slightly raised. The rhinophores themselves are large, entirely retracted, with 25-30 deep

perfoliations. As in the last species, the gills are very thick, strong, and muscular, apparently five, but in this case, too, the lateral pairs sometimes coalesce, so that the whole number may be counted as three or four. They are bipinnate. The oral tentacles appear as large, distinct tubercles on each side of the mouth, and were doubtless fairly long in life. The foot is rather broad, with a shallow groove in front; the upper lamina is connected with the sides of the mouth under the tentacles.

The internal organs are mostly of a greyish yellow, not deep black as in the last species. Though the labial cuticle contained a few scattered yellowish rods, no connected armature is visible. The radula much resembles that of *N. cristata*, and has for formula about $27 \times 10 + 1.1.1 + 10$ or occasionally $11 + 1.1.1 + 11$, but the median plate is broader, with five distinct denticulations which do not vary in number. The first lateral has a groove near the end of the hook, and the next two or three teeth have a rudimentary hamate shape. The liver is large. The upper wall of the pericardium is very thick and strong. The verge resembles the figures in Bergh's plates of *Nembrotha nigerrima*, the glans being armed with a profuse mass of hamate teeth. Those on the top seemed rather larger and more curved than in his figures.

This species is closely allied to *N. nigerrima*, but appears to be sufficiently distinguished by (a) its coloration, (b) the only slightly projecting edges of the rhinophore-pockets, (c) the absence of a labial armature, (d) slight differences in the radula, (e) another form of tentacles.

NEMBROTHA AFFINIS, sp. n. (Plate IV. figs. 3 a-3 d.)

[Cf. *N. gratiosa* Bergh, Nudibr. of 'Blake' Expedition, pp. 172-175.]

One specimen caught in a trawl in Chuaka Bay on the East Coast of Zanzibar. Very long and narrow, being 5 centimetres in length and 1 in height.

The living animal was extremely soft, dull violet-black in colour, with dull yellow stripes on the sides and somewhat brighter ones of the same colour on the back. The stems and bases of the gills were light green, and the same colour occurred between the rhinophores and round the edges of their pockets. The pinnae of the gills looked black, but when seen by transmitted light were of a fine purple. The foot was very narrow, and the animal could not adhere strongly to anything.

The alcoholic specimen is flabby, 28 millimetres long, 5 broad, and 10 high. As the result of this reduction in size, the yellow parts look wider and the black parts narrower, so that the animal appears to be yellow with black stripes, rather than black with yellow stripes as in Mr. Crossland's figure. No doubt, however, the latter is correct; it represents four lateral yellow stripes and one medio-dorsal. The stripes are interrupted in places, particularly on the tail, and there are some long yellow spots between them. The branchiæ are distinctly only three in number, smaller

than usual in the other species, but with a very thick rhachis and bipinnate. The rhinophores are large and exserted, each bearing about 35 perfoliations. The rims of the pockets are very slightly raised. The oral tentacles are two hard black ridges, curved downwards and sideways. The foot is narrow and grooved in front.

The buccal mass was extracted, but the animal was not further dissected in order to preserve the specimen. There is no labial armature. The formula of the radula is $13 \times 3 + 1.1.1 + 3$. The teeth closely resemble those of *N. gratiosa*, the chief difference being that the anterior margin of the wide median tooth (fig. 3 *c*) is indistinctly bilobed, the right half being always a little higher than the left. The first lateral (fig. 3 *d*) is large, rather irregular in shape, and with a double hook at the apex.

This form is closely allied to *N. gratiosa*, and were the latter found in the Indo-Pacific region, I should be inclined to regard them as varieties of one species. But *N. gratiosa* is recorded from the West Coast of Mexico*, which lies outside of the Indo-Pacific area; and it is therefore probable that the differences presented by the present animal are real and greater in living individuals. (*a*) It is not mentioned that *N. gratiosa* is remarkably soft. (*b*) The present specimen shows no traces of ridges near the rhinophores or on the tail. (*c*) The coloration of *N. gratiosa* is not dissimilar, but the pattern is spotted whereas here it is striped. (*d*) The tentacles do not look as if they had ever been ear-shaped. (*e*) The anterior margin of the median tooth is indistinctly bilobed.

MARIONIA.

[See especially Bergh, in Semper's Reisen, xv. p. 737, & xvii. p. 890.]

All the Tritoniadæ which I have collected in East Africa belong to this genus, unless the form described as *Marionia* sp. is regarded as sufficiently certain to constitute a new generic type. *Marionia* is distinguished from its near allies *Tritonia* and *Cundiella* by the presence of a circle of horny plates or leaves in the stomach. The velum bears distinct processes, which are often ramified. The edge of the jaw has one or more rows of denticles, and the radula is moderately wide. The central tooth is broad and more or less distinctly tricuspid. The laterals are hamate, but the first one is larger and clumsier than the others. Provisionally I think it best to divide the forms here described among six species, but am by no means certain that they will all prove valid. When more material can be examined it will probably be found that the species of *Marionia* exhibit many varieties in form and colour and run one into another. It is also not impossible that the denticu-

* In Bergh's 'System der Nudibr. Gasteropoden,' p. 1145, the locality is given as "mare indicum, Amboina," but this appears to be a slip. The animal is described by Bergh among the molluscs of Amboina, but is expressly said to come from Mexico.

lation of the jaw varies with age. Of the six species, *M. pellucida* seems distinct from the others, which are all nearly related to *M. arborescens*. *M. levis* is distinguished by being quite smooth and not at all tuberculate. *M. ramosa* is closely allied to *M. arborescens*, and differs chiefly in having unusually large branchiæ and appendages. *M. viridescens* and *albo-tuberculata* differ from these last two forms in having branched processes on the velum, and are closely allied one to another in structure, though by no means similar in external appearance.

It is noticeable that in none of these forms is the interior of the buccal cavity black, and that most of them have only one fully-developed row of denticles on the jaw.

MARIONIA PELLUCIDA, sp. n.

One specimen dredged in 10 fathoms near Wasin, East Africa.

The living animal showed very little colour but for the pink liver which shone through the transparent integuments. The back was sparsely reticulated with vermilion, turning to deep crimson near the bases of the branchiæ, and also bore some opaque white raised spots. The sides of the body were white and the edge of the velum sandy-coloured. The velum was not bifid, and bore 12 processes, of which 8 were 3-branched. The branchiæ were 13, of moderate size, directed backwards. The finer branches very delicate and transparent.

The alcoholic specimen is yellow, with small tubercles of a lighter colour on the back and sides. It is 15 millimetres long, 5 broad at most, and 4 high. The 13 branchiæ are rather far apart from each other; none are large, and the first pair as well as the last three are minute. The dorsal margin is not very prominent. The rhinophores are large. The velum as described above, but though the outermost processes probably represent the tentacles, they do not seem to be grooved as usual. The long narrow jaws bear three or four rows of denticles on the edge. The radula is at most $22 + 1.1.1 + 22 \times 25$, but many of the rows are much shorter. The central tooth is not very wide and tricuspid, the side cusps being as high as that in the middle. The stomach has a circular band of about 70 small yellowish plates, all of much the same size and usual triangular shape.

MARIONIA LEVIS, sp. n. (Plate IV. fig. 4.)

Six specimens from Chuaka, East Coast of Zanzibar, and Wasin, East Africa. Two were dissected.

The living animals were high and narrow in shape, with a flat back. The sides were described as white, mottled with translucent patches. The ground-colour of the back was a light purplish brown, with stripes of the same colour but darker and others of white. The branchiæ and rhinophores were pink with dark red blotches.

An uninjured alcoholic specimen is 26 millimetres long, 10 high,

and 7 broad in the widest part, but one which was dissected was about twice as large. The colour has become pale green, with a white reticulation on the sides and white stripes on the back. The skin is quite smooth, and there are no tubercles whatever. There are nine or ten pairs of branchiæ, of which the last three are quite small. The rhinophores have long raised sheaths with simple edges; the club is surrounded by six bipinnate plumes. The velum bears at each end a small grooved tentacle of the usual shape and six processes. The two in the middle are simple and smaller; the other four are larger and branched.

The jaws are white and membranous in the smaller and probably immature specimen, yellow and corneous in the larger one. In both there are from 20-30 very large blunt denticles, and also undulations near the edge of the jaw, which in the larger specimen sometimes develop into denticles, so that in about half the length there are two rows of denticles and here and there three. The radula consists in one specimen of 47 and in the other of 45 rows, with a formula of about $80 + 1.1.1 + 80$, which rises to as much as 85 marginals in one and 100 in the other for a few rows. The central tooth is broad and tricuspid; the median cusp is taller than the others, but not very pointed; all the cusps are rather irregular in shape, and have indentations here and there on the edges. The first lateral tooth is large, blunt, and very different from the rest in appearance. The others are hamate. The stomach has a girdle of about 150 horny, yellow, triangular plates of different sizes.

I do not think that this species can be identified with any of the forms the descriptions of which I have seen*. The coloration somewhat resembles *Tritonia rubra* Leuckart and *Tr. hawaiiensis* Pease, but the other details do not coincide. The species differs from the others hitherto found in East Africa in being quite smooth and having no tubercles.

MARIONIA ARBORESCENS B.

[Bergh, in Semper's Reisen, xvii. pp. 890-894.]

One specimen from near Wasin.

The notes on the living animal suggest that it is the same species as *M. ramosa*, and say that it differs chiefly in that the branchiæ, rhinophores, and processes of the velum are much smaller. The colour appears to have been the same as in that species (*i.e.* cocoa and green), and it is noted that there was a greenish tinge in the branchiæ. The back was warty.

The alcoholic specimen does not look much like *M. ramosa*. It is rather bent, but the length appears to be about 21.5 millimetres, the breadth 11.5, and the height 9. The back and sides are covered with flat low tubercles and the epidermis comes off in flakes. The dorsal margin is unusually prominent and projects 3.2 mm. It

* In this group as in others I have not access to the descriptions of a few forms by the older writers, e. g. *Tr. palmeri*.

bears eleven pairs of branchiæ, the main axis of which is bifid and the secondary axis bifid again. The first pair of branchiæ are set at the side of the rhinophores, which appear not to be on the dorsal margin, but this arrangement may be due to the contraction of the anterior part of the animal. The velum bears eleven simple processes of irregular length; the outermost are tentacular and grooved as usual.

The jaws bear a single row of very large, bent, almost hamate denticles with slight indications of a second row. The radula consists of 36 rows, with a maximum formula of $27+1.1.1+27$, but in most rows it is only about $15+1.1.1+15$. The central tooth is broad, and, as in *M. ramosa*, seems to bear five cusps. The stomach is provided with the usual girdle of about 100 triangular plates, all of much the same size.

This form appears referable with tolerable certainty to *M. arborescens* B.

MARIONIA RAMOSA, sp. n.

One specimen dredged in 5 fathoms, north of Kokotoni, Zanzibar.

The notes on the living animal are as follows:—"Colour cocoa-like. Two rows of big branched processes which are greenish in their finer divisions. The rhinophores and processes of the velum very long. The neck part is long and the whole creature has the shape of *Limax*. Length about $2\frac{1}{2}$ inches."

The preserved specimen is of a uniform light yellowish green, much bent, but about 27 millimetres long if stretched out. The back is only 8 mm. across, but the whole animal looks much broader on account of the large branchiæ. These are thirteen in number, set on the somewhat projecting dorsal margin. The first are a little behind the rhinophores and the last at the end of the tail. None are rudimentary, and the longest are 11 mm. long and almost ribbon-like. The largest tufts consist of three main stems, each of which is trifid again. The velum is ample and bears, in addition to two tentacles of the usual grooved shape, twelve simple digitate processes. The largest are 2 mm. long; the four in the centre are much smaller than the others. The sides and back are tuberculate. The rhinophore sheaths are 5.5 mm. high, with simple but ample and spreading margins. The club is surrounded by five plumes, once or twice pinnate.

The jaws are not very strong, and, except that the cutting-edge is yellow, colourless. Both bear about thirty large pyramidal denticles, at the base of each of which is a small accessory denticle. In parts there are traces of a second line, which might be regarded as mere ridges on the first line of denticles, but which in seven or eight cases seem to be independent formations. The transparent radula consists of 45 rows, containing at most 29 laterals, so that the formula is $45 \times 29+1.1.1+29$ as a maximum. The central tooth is much as in Bergh's plates of *Marionia arborescens* (S. R. Heft xvii. pl. lxxxviii. fig. 34), and, as

there, looks as if there were five cusps, but the median cusp is in this specimen thinner and more pointed than in the plates. The liver is large and yellowish. Embedded in the front part of it is the stomach, consisting internally of a large, soft, laminated portion, and a ring of about 120 yellowish, fairly stiff, horny plates. They are not all of the same size, the largest being 2 millimetres long and 1 high, and the smallest about half as large.

This species will perhaps prove to be only a variety of *M. arborescens*, from which it is distinguished chiefly by its long ribbon-like branchiæ, which give it a remarkable appearance. The jaws also present some differences.

MARIONIA ALBO-TUBERCULATA, sp. n.

One specimen from the neighbourhood of Wasin, East Africa. Dredged.

According to the notes on the living animal the sides were opaque white, with a reticulate pattern of red-brown. At the centre of each mesh was a small white projection. The back, which was dark brown at the sides and greyish in the centre, bore a similar arrangement of reticulations and projecting spots. The sheaths of the rhinophores were tall, and the wavy edges were turned over outwards. The branchiæ were much subdivided, and very large when fully extended. The main stems were of a light greenish grey, and the finer branches of a dark yellowish brown. The velum was plate-like, with five processes on each side, three of which were branched.

The alcoholic specimen is 45 millimetres long, 15 high, and 13 broad. It does not taper to a point behind. The colour is dirty yellow with profuse white markings. The stems of the branchiæ are spotted and striped with white. There are nine pairs of branchiæ of which the fourth is the largest, but the left-hand plume of this pair is much larger than the other. The middle and left-hand side of the velum are injured. There remain on the right-hand side, starting from the inside, (a) a bifid process, with three branches on each bifurcation, (b) a simply quadrifid process, (c) a simply bifid process, (d) a quite simple process, (e) a tentacle grooved below. Taking into consideration the notes on the living animal, it appears that there was a similar arrangement on the left side and that the middle of the velum was smooth. There is a small oval papilla below the fourth branchia, close to the dorsal margin. The genital papilla is lower down between the second and third branchiæ.

The jaws are yellow, horny, and large, being 9 millimetres long and 4 wide. They bear a single row of strong denticles, 10 of which are very much larger than the rest. Under five of the largest are indications of a second row. The radula is yellow, and consists of forty rows with a maximum formula of $95 + 1.1.1 + 95$. The central tooth is fairly broad and bears three cusps, of which that in the middle is pointed and those at the sides blunt. The

first lateral is large and clumsy : the rest are of the ordinary hamate shape. The internal organs are whitish. From the large buccal mass issues a tube 14 mm. long and nearly 5 mm. wide. The interior is lined with folds, and there is a pouch-like diverticulum in the floor immediately after the buccal mass. The tube is of much the same size until it dilates into the small stomach (7.5 mm. \times 5.5 mm.), which is under and partly within the liver. The stomach has a girdle of more than 100 plates, very thin and membranous, and all of about the same size, namely, 3 mm. along the base and 1.5 high. They lie in groups so as to produce a superficial impression of about 12 thick plates. The intestine is large.

MARIONIA VIRIDESCENS, sp. n.

[? = *Tritonia hawaiiensis* Pease.]

One specimen from near Wasin.

The notes on the living animal are as follows:—"Sides of foot light greenish brown, netted with light bright green, which becomes white near the edge of the back. There is a broad line of opaque white and green (a mixture resembling verdigris), which sends out prolongations to the bases of the branchiæ. Apart from this line the colour is reddish brown with a greenish network and white spots. This coloration extends into the main stems of the branchiæ, but the finer ramifications are white and the finest of all bright pinkish brown. The whole coloration is strikingly beautiful. The velum bears seven processes on each side; only the largest are branched. The rhinophores project but little from their pockets, which are as in *M. albo-tuberculata*. The branchiæ are kept moving continually, expanding and contracting. The animal is about 4 inches long."

The preserved specimen is 42 millimetres long, 21 broad, and 14 high. The shape is not tapering. The back and the sides bear small flat tubercles. The velum is large; besides the two small grooved tentacles it bears on each side seven processes, the largest of which have 2-4 short branches. The central space is wide and bears four rather indistinct tubercles not amounting to processes. The rhinophores are entirely retracted, and the club is surrounded by six bipinnate plumes. There are ten pairs of branchiæ, of which the fourth is the largest; they still bear traces of green colour. The stout and strong main stem divides into four branches, each of which bifurcates, and each bifurcation is then 3-4-pinnate. The arrangement of the smaller tufts is simpler, but none are rudimentary. The foot is very narrow, being, as preserved, only 2.5 mm. wide. The mouth is large and open, showing the jaws. It is surrounded by a circular disk with thin free margins. All this portion of the specimen seems to have been somewhat distorted by the preserving fluid.

The jaws are 9 mm. long and bear a single row of coarse denticles, of which ten are very large, the rest gradually decreasing

in size. There are only very faint traces of a second row. The radula consists of 37 rows, with a maximum formula of about $90+1.1.1+90$. The teeth are of the shape usual in the genus. The central tooth is finely striated, moderately wide and tricuspid, the central cusp being pointed, those at the sides blunt. From the buccal mass issues a long broad tube (4.5 mm. wide), which passes above and to the left of the genital organs, and then enters the liver, where it dilates into a stomach bearing a girdle of plates. These are about 120 in number, horny, fairly strong, brown, triangular, and of various sizes, the largest being 4 mm. long and 1.5 high, the smallest only a quarter of the size and white. The liver is large, yellowish externally, blackish internally.

In coloration this animal resembles *M. chloanthes* B., but can hardly be identified with that species on account of the differences in the velum, jaws, central tooth of the radula, and stomach-plates. I think it is very probably identical with Pease's *Tritonia hawaiiensis* from the Sandwich Islands, but his description is not sufficiently detailed to make identification certain, and the expressions "Veil strongly digitate," "Tentacles [*i. e.* rhinophores] retractile into . . . lacinated sheaths," hardly apply to the present specimen.

M. virescens and *M. albo-tuberculata* are closely allied and possibly only varieties of one species; but the present specimens exhibit some differences in the velum, median tooth, and digestive organs, as well as in coloration.

MARIONIA, species.

One small specimen, dredged in 10 fathoms off Wasin.

It was dead when found and of a uniform opaque white. The velum was hardly digitate, but presented six undulations. The foot was broad.

The alcoholic specimen has become deep brown and is somewhat decomposed. It is 5 millimetres long, 2 broad, and 1.5 high. The back is tuberculate, with a slightly projecting margin, which bears on each side 6 small branchiæ set at a considerable distance from one another. The rhinophore-pockets are raised and simple. The velum appears simply circular.

No jaws could be discerned. The radula was extremely small, and on a superficial examination appeared to be uniseriate, but on careful investigation was found to have the formula 5.1.5. The laterals are all alike, thin and hamate. They are folded over the central tooth, a narrow plate with slight indications of being tricuspid. The stomach contained about 80 yellow plates, all of much the same size.

This is perhaps an immature form in which the jaws are membranous; but, if so, it is remarkable that the stomach-plates are fully developed. The extreme narrowness of the radula is also remarkable. The characters as described above are sufficient to constitute a new genus, but I hesitate to do this on the evidence of one minute specimen.

BORNELLA.

The members of this genus are slender, elegant animals, having on either side of the back a row of cerata mostly divided into 2-4 branches and bearing gills. On either side of the mouth is a compound tentacular process consisting of a number of conical tubercles set in a sort of rosette. Over the head are a pair of large organs called in the following descriptions for brevity's sake rhinophore-sheaths, but apparently formed by a fusion of the true rhinophore-sheaths with a pair of cerata. The pair of cerata after these organs are called the first pair. The vent is latero-dorsal between the first and second pair of cerata. The buccal mass is not large, but very muscular; besides the jaws and radula, there is also a labial armature of scales. The radula consists of a median tooth, roughly triangular, either smooth or denticulate, and a few (9-19) smooth hamate laterals, bent somewhat forward. The innermost are generally very small, and the size increases towards the outside of the row. There are two stomachs, of which the second is armed with spines, and two accessory livers, besides the main mass. As a rule ramifications of the liver enter the cerata, but there is some irregularity in this respect. The hermaphrodite gland lies on the liver; the præputium is smooth or armed with spines.

There is considerable difficulty in dividing the genus into species. The colour presents little variety, being in all the known forms whitish yellow, with a red or yellow reticulation on the back. On the other hand, there is some variety in both the external and internal organs. The number of the cerata and their subdivisions appears not to be specifically characteristic, but to increase with age, and is not always the same on the two sides of the body. The ramification of the liver may be present or absent in the same species (*B. excepta*; see Bergh's two descriptions), and, when present, may not extend to all the cerata. The armature of hooks on the præputium may also be present or absent in the same species (*B. digitata* and *B. arborescens*; see Bergh). Nine species are recorded, but *B. hermanni* Angas, *caledonica* Crosse, *adamsii* Gr., *semperi* Crosse, and *hancockiana* Kel., will hardly prove valid, for even if they represent specifically distinct forms they are insufficiently characterised. Of the remaining species *B. calcarata* Möreh, from the West Indies, is distinguished by having appendiculate rhinophore-sheaths and smooth median teeth. The Indo-Pacific forms fall into two groups—the one represented by *B. digitata*, with a single process behind the rhinophores, cerata divided into rather long erect fingers, and median teeth with faint denticulations; the other by *B. excepta*, with several processes behind the rhinophores, small fingers on the cerata protecting the external branchiæ, and much more distinctly denticulate median teeth. Whether *B. digitata* and *B. arborescens* are really distinct is discussed below. *B. simplex*, n. sp., is certainly a separate species, unless it is a monstrosity.

My specimens seem to be on the whole smaller than those of Bergh and to have fewer cerata.

BORNELLA DIGITATA Adams. (Plate IV. fig. 5 a.)

[A. & H., Notes on a Coll. of Nud. made in India, p. 140, pl. xxxiii. figs. 8, 9; Bergh, S. R. vii. p. 301; id. Danish Exp. to Siam, Opisthobranchiata, p. 199.]

Several specimens from Zanzibar Harbour (Bawi and Prison Island).

The living animals were white, with a granulated surface. On the back was a reticulate pattern of deep orange. The cerata were tipped with opaque white, below which was a band of bright orange. The transparency of the body-walls varied in different specimens. In some the liver and its ramifications were clearly visible.

The following description, when not otherwise stated, applies to the largest alcoholic specimen; the others are much like it, but the smaller ones are only half the size. Length 30 millimetres, breadth 4, height 8·5; much compressed laterally. On each side of the mouth is a large branched process with about fifteen subdivisions; of these the four or five uppermost are larger and digitate; the remainder are round and tubercular. The back bears a pair of rhinophores with appendages, and, as a rule, four pairs of cerata behind them. The largest specimens have a fifth pair of small cerata, which in one case are fused together into a single process. The rhinophore-sheaths are raised; they bear in front three small digitate processes, and behind one long tapering process which rises 5·5 mm. above the rhinophores. The first pair of cerata are divided into two large and two small fingers; the right-hand member of the second pair into two approximately equal fingers, and the left into two large and one small; the third into one large and one small finger; the fourth are simple; the fifth are merely small warts. In the smaller specimens the first pair of cerata are trifid only, and in the smallest bifid, with indications of an incipient third digit. It appears probable that the number of digits increases with size and age. The first pair of cerata bear three branchiæ, the second, third and fourth two, the fifth none. The branchiæ are all on the inner side of the cerata and set close together.

The labial armature consists of small overlapping scales, arranged in fairly regular rows. The edge of the jaws is quite smooth. The radula consists of 34 rows. The median tooth has a long central cusp, with from 8 to 10 denticulations or ridges at the base. In most rows there are 9 laterals, increasing in size from the innermost outwards, but in some the number rises to 13 and 15. The walls of the second stomach are raised into folds on which are set large brown thorns, with rather blunt tips. The ramification of the liver appears to be very irregular and to vary in different specimens. In the largest the arrangement is as follows:—A single branch runs up into the tall tapering process behind each

rhinophore; the first pair of cerata receive no branches at all; the second and third receive on the right hand a branch which bifurcates, and on the left a simple branch which, in the third, stops at the base of the cera and does not enter it. The remaining cerata receive no branches.

I think these specimens are the *B. digitata* described by A. & H. and by Bergh. The best external character seems to be the tapering, finger-like shape of the cerata and of the process behind the rhinophores, to which no doubt the specific name is due.

BORNELLA ARBORESCENS Pease.

[Bergh, "Neue Naektschnecken, No. ii." Journ. Mus. Godeffroy, Heft vi. 1874, p. 96; id. S. R. xvii. p. 886.]

Several specimens from Mombasa Harbour. Note on living animals: "Yellowish white, with red reticulations on back and red tips to cerata."

The alcoholic specimens are all much of the same size. All are whiter and more compressed than those of *B. digitata*, and the cerata are much smaller. The average dimensions are:—Length 20 millimetres, height 6, breadth 3; rhinophores and cerata about 2 mm. high. The tentacular processes at the side of the mouth consist of only about six digitations. The rhinophores are as in *B. digitata*, but the posterior process is not so long. In most specimens there are five pairs of cerata, of which the first three are bifid and the remaining two simple. Each, from the first to the fourth, bears two gills, the fifth none. The jaws and labial armature are as in *B. digitata*; the formula of the radula is about $40 \times 9.1.9$, rising sometimes to $12.1.12$. The teeth are much as in Bergh's plates (Journ. Mus. Godef. *l. c.* plate iv. 12), but the central cusp of the median tooth is rather longer. The median tooth is more erect than in *B. digitata*, and the 8–10 denticles which it bears less distinct and very hard to see. The other characters are as in *B. digitata*.

It is not easy to say whether this form is specifically distinct from *B. digitata* or, if so, whether it should be called *B. arborescens*. It represents, however, at least a well-marked variety or stage of growth in which the tentacular processes, rhinophores, and cerata are less amply developed. It could hardly be identified with *B. arborescens* on the strength of the original description by Pease (Amer. Journ. of Conchol. vi. 1871), but in the revised description by Bergh (Mus. Godef. *l. c.*) the chief specific character seems to be "*papillis anterioribus ut plurimum bipartitis*." In these specimens they are invariably bifid. With regard to the hooks on the præputium, I was unable to see the difference mentioned by Bergh, and found only simple or bifid hooks, not trifid, in both species.

BORNELLA EXCEPTA B. (Plate IV. fig. 5 b.)

[Bergh, Challenger Reports, Nudibranchiata, p. 36; id. Danish Exp. to Siam, Opisthobranchiata, p. 202.]

One specimen from the East Coast of Zanzibar. Notes on living animal: "Rhizophore bearers very large indeed; colour whitish, netted with orange."

The alcoholic specimen is more stoutly built than those already described. It is somewhat bent, and would be at least 30 millimetres long if stretched out. It is 5 mm. high and 4.5 broad. The rhizophore-sheaths are 8 mm. high, the cerata 5.5.

The tentacular process consists of 11 fairly long digits, all distinct and none of them merely tubercles. The large rhizophores bear 7 digits, three in front quite separate, and five behind united at the base. Posteriorly there are traces of what may be a crest. Behind the rhizophore-sheaths are three pairs of cerata, somewhat resembling those of *Doto* in general appearance. They all bear three digits, above which rises the top, covered with knobs. They also all bear three stout branchiæ, two of which are visible from the outer side and are protected by the digits.

The jaws and labial armature are much as usual; the former have blunt indentations on the edge. The radula consists of 27 rows with a maximum formula of 16.1.16. In the median tooth the central cusp is rather longer than depicted by Bergh, and there are 10-12 denticles and ridges on each side. The second stomach and the præputium are armed with black spines as described by Bergh (Chall. Rep. *l. c.*). The liver sends branches into all the cerata except the right-hand member of the first pair, but not into the rhizophore-sheaths.

I am somewhat doubtful if this is really Bergh's *B. excepta*: there are differences in the arrangement of the cerata and branchiæ and the rhizophore-sheaths are relatively much larger. On the other hand, the two specimens examined by Bergh did not agree in details, and the present animal possesses more or less the characters common to them.

BORNELLA SIMPLEX, sp. n. (Plate IV. fig. 5 c.)

One specimen from Chuaka, East Coast of Zanzibar. The following are the notes on the living animal:—"Very like *B. digitata*, but a distinct species. Anterior tentacles short and simple. Whole coloration transparent, so that the walls of the heart are distinctly visible. No opaque white or orange rings on tips of cerata, but an orange network on the back and a row of opaque white dots on the sides. Eyes not visible. Length 12 millimetres."

Superficially the alcoholic specimen looks much like *B. excepta* as described above and has the same *Doto*-like cerata, but it is at once distinguished by having on each side of the mouth not the usual tentacular rosette, but a single simple tubercle. The left tubercle is larger than the right. The rhizophore-sheaths bear six short digitations and a larger rounded knob behind. There are four pairs of cerata, of which the hindmost are simple warts. The others are similarly constructed, though the third pair are smaller than the first two. Each is divided into four knob-like

divisions, and bears a pair of trifid feathery branchiæ, one anterior and one posterior.

The mouth-parts were taken out soon after the specimen was captured, and as preserved consist of a labial armature and radula, but no jaws. It is very likely, however, that the jaws had been lost and were not really absent. The labial armature is much as in *B. digitata*. Many of the scales are heart-shaped. The formula of the radula is $21 \times 9 + 1 + 9$, the number of laterals being constant in all the rows. The median tooth has 7-8 very strong denticles on each side of the central cusp, which does not project much. The laterals are rather short and straight. The second stomach is armed with spines as in *B. excepta*. The liver sends off diverticula into the process behind the rhinophores and all four pairs of cerata. Those which pass into the rhinophore-sheath and the fourth pair of cerata are simple, while those that pass into the other cerata are divided into four branches corresponding to the divisions of the cerata.

The simple tentacles of this animal are a sufficient specific, if not generic character, provided they are normal. It is possible that they are a monstrosity, for it is not uncommon in nudibranchs for external processes to remain undeveloped, for example, I have a specimen of *Ceratosoma cornigerum* in which the characteristic lobes are wanting. But apart from the tentacles, this specimen does not exactly correspond with *B. excepta*, for instance as regards the rhinophore-sheaths and radula. The median tooth has fewer and stronger denticulations; the laterals are fewer, shorter, and straighter.

PLEUROLEURA ALBA, sp. n.

[Cf. *Pl. striata* van Hass., Eliot in Nudibr. of Maldives and Laccadive Archipelagoes, p. 566-7.]

Two specimens from Zanzibar. The following are the notes on the living animal:—"Back white with distinct low ridges, longitudinal but not parallel to median line, each with a yellow line along its summit. The rhinophores stand vertically or point forwards and bear longitudinal perfoliations. The base is white, the main part black, the apex truncated and yellow. They are not retractile into pockets, but can be withdrawn under the mantle-edge. They are not very sensitive. The large velum and the mantle are edged with bright yellow. Foot not half the width of mantle. In crawling, the underside of the mantle is applied to the substratum over which the animal moves. Length 13 millimetres, breadth 4 mm."

The dimensions and colour of the preserved specimen have not much altered, though the yellow has become faint. The shape is elongate and tapering. The maximum breadth just behind the rhinophores is 4 millimetres, rapidly decreasing to 3 mm. and 2 mm. One striation runs down the middle of the back; on each side of it are six to eight others, not parallel to it and starting

from various points. The external characters are those of the genus.

The mouth-parts on the whole resemble those of *Pl. striata* as described by me (*l. c.*). The formula of the radula is $23 \times 6 + 1.1.1 + 6$. The rhachidian tooth has a long central cusp and about six denticles on each side. The first lateral is practically half the rhachidian tooth, having one tall cusp and about six denticulations parallel to it and rising from the base on the outside. The remaining teeth are simply hamate. The jaws are more membranous than in *Pl. striata*, and bear six distinct rows of denticles.

This form is closely allied to *Pl. striata*, but differs strikingly in colour, that animal being black with yellow lines. Such variation in colour is not impossible within the limits of a species, but in this case it is accompanied by other differences:—(1) The shape is more elongate; (2) the radula is narrower; (3) the first lateral is differently shaped. These points seem sufficient to constitute provisional specific rank, though it is quite possible that the form may ultimately prove a mere variety of *Pl. striata*.

EXPLANATION OF THE PLATES.

PLATE III.

Figs. 1 a–1 g. *Notodoris minor*, p. 84.

1 a. Lateral view of living animal. 1 b. Dorsal view of living animal. 1 c. Hinder part of body with the valves raised and spread. 1 d. Gills with the valves removed. 1 e. Ventral view of anterior part of body. 1 f. Glans penis. 1 g. Three teeth.

2 a–2 f. *Trevelyana coccinea*, p. 85.

2 a–2 d. First laterals of various shapes. Teeth from (2 e) middle and (2 f) end of row.

3 a–3 c. *Trevelyana ceylonica*, p. 86.

3 a. First lateral tooth. 3 b. Teeth from the middle of a row. 3 c. Three teeth, seen from below and behind.

4. *Trevelyana crocea*, p. 87.

PLATE IV.

Figs. 1 a–1 c. *Trevelyana bicolor*, p. 89.

1 a. Lateral view of living animal, with the liver (the blackish tint) showing through the translucent body-wall. 1 b. Ventral view of crawling animal, showing the proportions of the foot and some of the internal organs through translucent body-wall. 1 c. Gills as seen fully expanded. Figs. 1 a and 1 b are $\times 5$.

2. *Nembrotha cristata*, p. 90.

Middle of radula.

3 a–3 d. *Nembrotha affinis*, p. 92.

3 a, dorsal and (3 b) lateral views of living animal. 3 c, median and (3 d) first lateral tooth.

4. *Marionia levis*, p. 94.

5. Median teeth of (5 a) *Bornella digitata* (p. 101), (5 b) *B. excepta* (p. 102), and (5 c) *B. simplex* (p. 103).



1a.



1d.



1b.



1c.



1f.



1g.



1e.



2a.

2b.

2e.

2f.

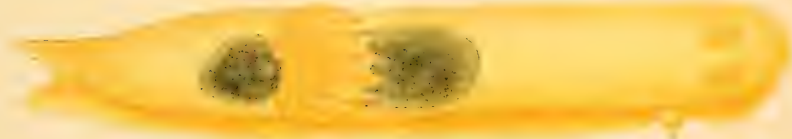
2d.

3c.

3b.

3a.

2c.



4



C. Crossland, del.

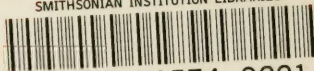
Huth, sc. et imp

1. TREVELYANA BICOLOR. 2. NEMBROTHA CRISTATA.
3. N. AFFINIS. 4 MARIONIA LEVIS 5 TEETH OF (a) BORNELLA DIGITATA
(b) B. EXCEPTA AND (c) B. SIMPLEX





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